

Anomalies of History

by J. O. Quantaman

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Angular separations between Venus and Mercury follow a recurring pattern over forty years or tentatively 14,600 days. The 40-year cycle covers two distinct phases separated by six-year Transition periods.

I have discovered this behavior while doing a statistical analysis of the angular separations between Venus and Mercury. The analysis will be shown in the opening sections of this report. Then I will match historical events that concur with the six-year Transition periods. The events include many examples of cultural reforms in the wake of social upheavals, revolutions, wars and technological breakthroughs.

Please do not confuse this report with a deterministic approach to history. Quantum theory has shown that determinism is impossible, for the universe doesn't have enough storage space to chain-link every effect to its cause. The arrow of time points in one direction only. When a soft-boiled egg rolls off the table and splatters across the floor, there is no easy way to reverse the process and make the egg whole again.

Each of us has many choices to deal with whatever circumstances. But life doesn't work like a digital network. In real-life, you can't take back a bad chess move. Nor can you take back a serious physical injury as if it was a matter of restoring a corrupted OS to its former state. You

must live with your choices and bear the results of your actions.

Suppose Time represents more than a linear chronology. Suppose Time has quality components that manifest at regular intervals. If so, there must be a class of events that manifest around such qualities.

Let us focus on events that influence or trigger cultural changes. Such events include regional conflicts, pitched battles, changes in political leadership, social upheavals and technological innovations.

The history of culture can be viewed as the revaluing of longterm memory. History shows that memory has become depersonalized and reinvested in the public domain.

Indeed, everyone retains bone-marrow memory. All of us have the urge to survive: to eat when we're hungry, to drink when we're thirsty and to sleep when we're tired. But life involves more than breathing and slouching before a TV. We must earn the right to shelter and modest happiness.

Luckily, humans have been social creatures from the very start. If someone in a hunting & gathering tribe knows how to start a fire, all members of the tribe stay warm overnight. If another is swift of foot and strong of arm, all members of the tribe will have cooked meat to eat for dinner.

As the tribe gathers around the glowing embers, a 3rd-person may chant praises of the hunter's bravery and the firemaker's skills. So the entire tribe learns of the methods used to slay a stag or coax a fire after torrential downpours. When the heroes grow older or succumb to injuries, younger members of the tribe have the basic know-how to fill these vital roles.

In prehistoric times, word of mouth language was all that was

needed to spread knowledge from one generation to the next.

The earliest agricultural societies set aside a cadre of bards who were charged with keeping the history of the people. In Celtic Europe, druids would wander of village to village. During festivals and tribal gatherings, the druids would sing of heroes and villains, wise counselors and fools, glorious victories and tragic defeats. Although Celts didn't record history, the highlights from scores of generations were preserved in the songs of the bards.

Eventually human social interactions grew more complex. Merchants needed reliable grocery lists, inventories of products, customer orders and accounts. They used posters as calendars to mark the dates when debts would be collected or paid off. Bankers issued written receipts for gold or silver they held in trust.

The first languages were largely iconic or hieroglyphic with separate glyphs for numbers. Wealthy businesspersons no longer had to remember every last facet of their holdings. Instead they called their chief scribes who'd read the particulars from clay tablets or scrolls.

The Phoenicians invented an alphabetical script which was soon emulated by the Greeks and Romans. The Egyptians provided durable papyrus sheets that rolled into compact scrolls for easy conveyance. A new class of scribes used ink to scribble vital facts and figures for governing magistrates, high priests or commercial financiers. Popular ballads were written down. These included *Gilgamesh*, *The Iliad* and *Odyssey*. Historians began to record current events as well as myths and popular conceptions of prehistorical eras. A group of scribes on the eastern shore of the Mediterranean Sea gathered myths from Mesopotamia and combined these with Egyptian tales and local

folklore. Over many years the edited texts became the present-day versions of the Bible, Torah and Koran.

In the last century of the Roman Republic and the 1st-century of the Roman Empire, books existed only in private or municipal libraries. There was no easy way to duplicate a book other than to copy it painstakingly word for word. Most of the folks who lived around the Mediterranean were illiterate. Even fewer were able to write, although many Roman citizens were fluent in Latin, and most Roman aristocrats knew both Latin and Greek.

Young men who enlisted in the Roman legions were taught to read and write. This practice was adopted around 100 B.C. by Marius who was also the 1st-general to enlist commoners in the legions. Subsequent generals continued to bring language tutors into winter quarters until about 250 A.D. when legions were supplemented with foreigners and mercenaries, many of whom were captured or conscripted barbarians from outlying tribes.

During the Greco-Roman era, rhetoric was far more important than written proclamations. Successful leaders were capable public speakers. Tutors required students to memorize large sections of popular books, such as the *Iliad* and other fictional histories as well as the texts of playwrights, philosophers, geometers and historians. Students learned by rote. Politicians spoke from memory. Entrepreneurs had the knack for summing figures in their heads. Since it was difficult if not impossible to distribute copies, written laws and edicts were engraved in copper at the governor's palace. Such bylaws were spread through the district by word of mouth.

Recorded texts allowed the bureaucracy to function, but most day-

to-day arrangements happened face-to-face with spoken words. Men and women needed keen memories to keep their wits on track.

As Roman culture collapsed and human misery grew with the dissolution of the Empire, another cadre of scribes gathered around Christian bishops and abbots. Monks and impoverished scholars helped to preserve a few of the important books during the Dark Ages. Nonetheless, literacy fell to all-time lows. Noteworthy kings had to call on their scribes before they could decipher their wives' memos.

This sorry state of affairs continued until the 13th-century when Mongol hordes conquered huge tracts of Asia and Eastern Europe. They promoted trade throughout their vast empire. A Chinese entrepreneur managed to mass produce playing cards using block type. Card games were very popular among the folks who accompanied caravans hauling trade goods over vast distances: from Damascus to the Beijing, from Baghdad to Delhi or from Hong Kong to Moscow.

200 years later, Gutenberg invented the printing press. Yet, superstition had become so embedded that it took several centuries before printed books made significant impact. If anything, printed books helped westerners recover their long-lost heritage via translations of Arabic texts. Major innovations came more often from ocean explorers who found new continents and brought back wild tales and hoards of gold.

While Luther was handing out pamphlets that questioned the supremacy of the Catholic church, school kids in China were reading finely bound text books of botany, astronomy and philosophy. The Mongol-inspired expansion of international trade helped dig Europeans out from the dismal Dark Ages. New knowledge, fine silks

and spices also brought fleas and the Black Death, which spread plague and overfilled graveyards from Manchuria to Iceland and from Thailand to Morocco. City folk suffered the most. Thus, populous China lost more than half its citizens in a few short years. Western Europe observed wretched sanitary practices, which offered a bonanza for flea-infested rats. Europeans lost nearly a third of their fellows.

Gutenberg's printing press helped to bring on 300 years of insane religious wars (also abetted by ethnic rivalries and plain-old personal vendettas). It took longer for printed books to make positive impacts. The most important was the innovation of public schools, although parents had to be members of the upper classes before their kids would be included. Tutors were suddenly faced with ballooning class sizes. They had to devise new methods to test and grade their charges. The learning process was still largely by rote, but the amount of source material increased by a hundredfold. A few misguided crackpots had the nerve to teach students how to think. But their modest results raised such a ruckus that the crackpots were soon given one-way tickets to the Americas or Australia.

Pamphlets were the biggest beneficiaries of the printing press. Pamphlets appeared on every street corner. Folks couldn't walk their dogs without getting handed two or three. In those days, folks hadn't learned the downsides of junk mail. Many took the pamphlets home. Some even managed to read them. Others who couldn't read treasured them as if they could.

The pamphlets contained everything from fantastic recipes for cheese-stuffed dumplings to Elmo's famous hair restorative. Pamphlets also contained diatribes on almost every topic, including incitements to

revolution. Soon the police were out in force, questioning every pamphleteer. The police arrested dozens, but the left the most flagrant junk dealers alone.

Pamphleteers evolved into newspaper conglomerates that printed dailies, weeklies and monthlies. Some of the monthlies included purloined booklets for the ladies. Newspapers had scores of adverts on every other page. The news sections contained valuable information, such as weather predictions, special events, train schedules and the visits of ships to local ports. Folks began to see things beyond the sightlines of their neighborhoods. They began to see themselves as members of a city, or some cases, citizens of a nation. Knowledge of simple everyday events became more widely known. For instance, readers of newspapers would learn about freak fires at apple orchards, so they'd run down to the store and stock up on apples before the prices went through the roof. Information became a convenient advantage, though folks soon forgot about yesterday's news when tomorrow's news promised another bag of goodies.

Let us jump to the present. The public media is pervasive. We are deluged with radio waves, television images, billboards on transit buses and advert banners on almost every website. We have millions of options and appeals at our finger tips. We have musical accompaniment in elevators, shopping malls and grocery stores. We can play games with ourselves or others online. We're linked to dozens of friends and retailers. 99.9% of what we hear and see is irrelevant. It goes in one ear and out the other. Yet the info never stops, not for a minute, not for a second.

Without written and/or electronic records, we would be lost as

polar bears on tropical islands. Without proper credentials, we couldn't even get to 1st-base, let alone close the deal on a new car or a new house. To arrive where we are today, we've had to relinquish our personal memories and bequeath them to the public domain. We've thrown our two-cents worth in with everyone else's, and somehow everyone benefits. Never in history have folks enjoyed so many conveniences, so many options and freedoms.

If we look back at recent history, we see that innovations have driven changes in the social fabric. Even so, upstart technologies don't take root until folks are ready to embrace them. Wars and social conflicts create powerful incentives to adopt new gadgets, especially when the gadgets promise to turn defeats into victories.

I will show how violent conflicts occur more often during the six-year Transition periods. The evidence for this is presented in the later sections of this report. Technological innovations will furnish the impetus for both conflicts and stalemates. And don't forget...

The development of nuclear weapons has postponed the advent of World War III. The great powers haven't dared to risk civilization-ending chaos. The most lethal weapons known to man have idled in their silos for more than 60 years.

I've studied many proposals for cyclical history. All of these have been way up in the clouds or focused too narrowly to encompass the sweep of culture. None of the proposals, to my knowledge, have been put to a rigorous statistical analysis.

The 40-year cycle may prove no better than the others. It won't predict the weather ten years from now. It won't help you get rich in the stock market. It won't predict with certitude the occurrence of

future wars. If anything, the 40-year cycle will let you appreciate the tidal flows of history. Regard the six-year Transition Periods as anomalies from a commonly accepted norm.

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Geocentric

If you watch the night sky with binoculars after sunset or before sunrise, you will observe the geocentric positions of Venus and Mercury. From the perspective of earth, they will be separated at angles between zero degrees and 73°.

Using published ephemerides, I've recorded the daily Mercury-Venus separations from 1891 through 2050. [See Endnote #1] The results are documented annually in 160 Excel workbooks. They include 58,439 individual recordings. The individual workbooks as well as a summary workbook can be made available to academics who wish to confirm the primary data.

Mercury and Venus orbit at different speeds depending on their positions with respect to Sun. When they track behind the Sun, they move faster since their motions are added to the apparent motion of the Sun. When they pass before the Sun, they appear to move backwards for short periods. This backward motion is an illusion caused by our geocentric perspective. Astronomers call backwards motion retrograde passage. Mercury goes retrograde about three times per year, whereas Venus goes retrograde once every year and a half. Their angular separations change rapidly whenever one of the planets goes retrograde, since the forward-moving planet will leapfrog the planet tracking in reverse.

There is a consistent pattern in the angular separations of these planets. For periods of 11 years, Venus and Mercury tend to range close together. Less than 15° from each other. Let us call these Near

periods. Next there are periods of 17 years when Venus and Mercury tend to fall further apart. Between 46° and 73°. Let us call these Far periods. Lastly, there are six-year Transition periods sandwiched between the Near and Far periods. Eleven years plus seventeen years plus two six-year periods add up to 40 years.

The table below sums the angular separations of Mercury and Venus for the Near Periods. In other words, for the years 1902-12 & 1942-52 & 1982-92 & 2022-32.

Near Periods (44 Years)		
Degrees	Total	Percent
Joiner (0-14)	4,760	29.6%
Midway (16-44)	7,405	46.1%
Sextile (46-73)	3,369	21.0%
Null (15 or 45)	538	3.3%

The percentage deviation may seem small, but it represents a significant difference in the behaviors of angular separation between Mercury and Venus.

During the Near periods, Mercury and Venus will hug each other like young lovers for two or three months at a stretch. They will separate out to 15° or 25° only to resume close contact once again. On rare occasions when maximum separations occur, the planets will split apart as far as 73°.

During the Far periods, Mercury and Venus will exchange places frequently, with Venus leading the way, then Mercury leading the way. Their angular separation often go from 65° to zero degrees two or three times in the same year.

The table below sums the angular separations of Mercury and Venus

for Far Periods. In other words, for the years 1891-95 & 1919-35 & 1959-75 & 1999-2015 & 1939-2050.

Far Periods (68 Years)		
Degrees	Total	Percent
Joiner (0-14)	5,266	21.2%
Midway (16-44)	12,233	49.3%
Sextile (46-73)	6,785	27.3%
Null (15 or 45)	552	2.3%

The difference of behavior is so distinctive that ancient astronomers must have noticed. Early astronomers may have used the span of the 40-year cycle to cross-reference the length of the year. Accurate knowledge of the year's length allowed high priests to predict spring floods and the best times for planting and harvesting crops. The Babylonians, Egyptians and Mayans used 360 as a 1st-guess for the seasonal year. Later they added five extra days. The Egyptians advised Julius Cæsar to add a 6th-day every four years. This proved a great boon for the Romans whose calendar strayed by more than 60 days from the seasons. The Julian calendar worked fine for 15 centuries until Pope Gregory XIII shifted the calendar 13 days and then devised a scheme for skipping the leap year once per century, except for certain centuries according to a complex rule of thumb. This calendar (with minor revisions) is still used today, and astronomers have gaged the seasonal year at 365.242191 days. [See Endnote #2]

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Heliocentric

The heliocentric behaviors of Mercury and Venus follow the true orbital positions of the inner planets. Imagine you are looking straight down on the plane of the Earth's orbit around Sun and from a great distance directly above the Sun. For each orbit of Earth, Mercury travels about four orbits around the Sun, whereas Venus travels 1.6 orbits around the Sun. Venus and Mercury catch each other every four or five months. During these connections, the Earth may be joined with the inner planets or directly opposite them on the other side of the Sun, or ranging at any angle before or after them.

To see why this is important, consider the analogy of a baseball game. Imagine home plate is the place of the Sun. The inner planets occupy the infield while the outfield represents the viewpoint from Earth. The batter hits a hard bouncer toward the 2nd-baseman, who jogs to his right to field the grounder. Meanwhile the baserunner scampers from 1st-base to 2nd-base. The catcher at the heliocentric perspective sees the baserunner crossing before 2nd-baseman. At the same moment, the left fielder observes the same play from a geocentric perspective. He watches the runner advancing toward 2nd-base, while the 2nd-baseman fields the ground ball on the outfield grass. The left fielder sees the runner and 2nd-baseman separated by a fair distance.

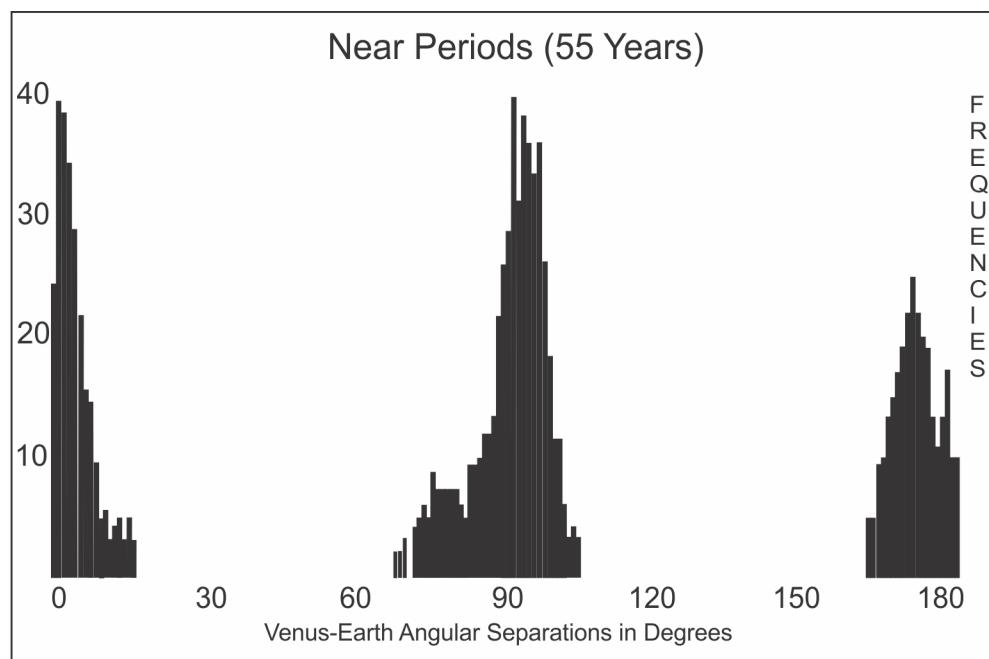
If the "geocentric" sun lies behind a Mercury-Venus conjunction, both inner planets will go retrograde at the same time. The duration of joining will appear longer when viewed from earth.

If the "geocentric" sun is at 90° at a Mercury-Venus connection, the

inner planets will appear to hang loosely apart between 10° and 20° , until they pass before or behind the sun when they reconnect.

Angular relationships of Earth to the inner planets are crucial to the 40-year cycle. I have extended the heliocentric study another 40 years into the past. [See Endnote #3]

Below you will see a graph of the daily separations of Venus-Earth during the Near periods covering the years 1851-2050, when Mercury and Venus are within 9° of each other. The recorded periods are 1862-72 & 1902-12 & 1942-52 & 1982-92 & 2022-32.

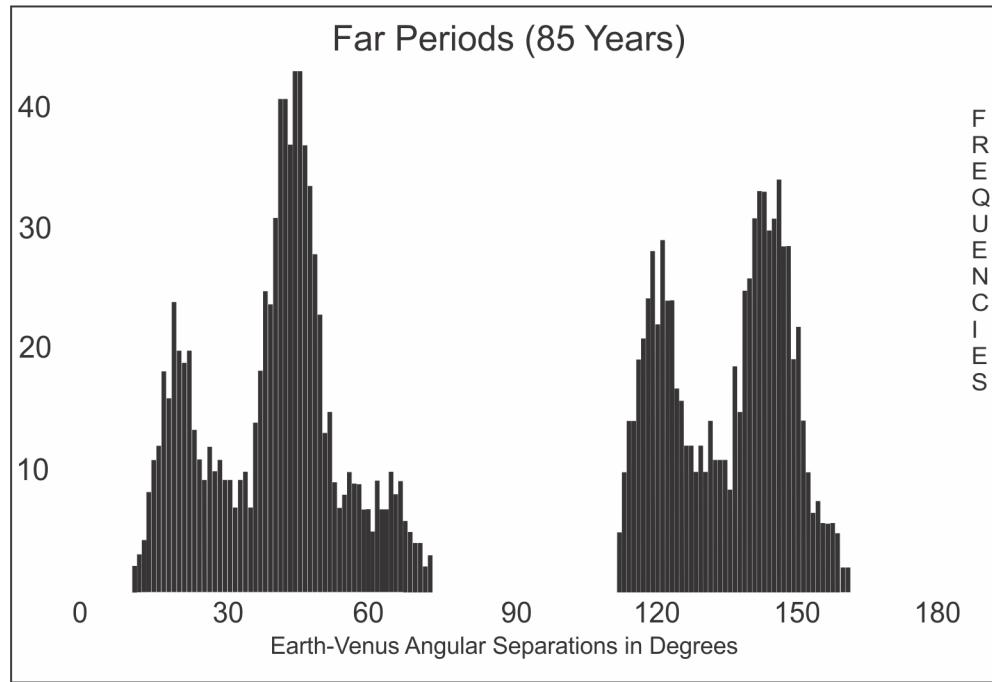


During the Near periods, the Venus-Earth separations cluster around zero degrees, 90° and 180° . This graph will look almost identical to the graph of Mercury-Earth separations, since both samples would be taken when Mercury and Venus are close together.

During the Far periods, the Earth-Venus angular separations cluster around 45° and 135° while avoiding those separations common for the Near periods.

Below is a graph of the Venus-Earth daily separations during Far

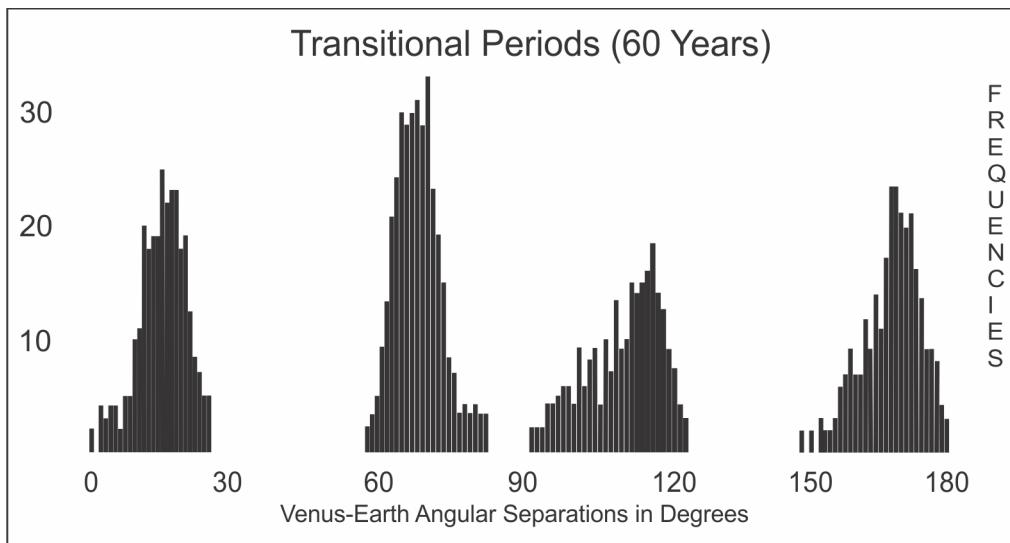
periods covering the years 1851-2050, when Mercury and Venus are within 9° of each other. The recorded periods are 1851-1855 & 1879-1895 & 1919-1935 & 1959-1975 & 1999-2015 & 2039-2050.



If sun is at 45° or 135° during Mercury-Venus connection, bizarre changes in perspective may take place. Mercury and Venus may exchange lead positions, wavering between conjunctions and wide-separations, only to reverse the process. Heliocentric behaviors account for the differences in geocentric actions of Mercury and Venus.

For the Transition periods, the Earth-Venus separations avoid the zero degree, 90° , 180° maximums of the Near periods. They also avoid the 45° and 135° maximums of the Far periods. Indeed they are migrating between the Near and Far distributions.

Below you will see a graph of Venus-Earth daily separations covering the years 1851-2050, when Mercury and Venus are within 9° of each other. The recorded periods are 1856-61 & 1873-78 & 1896-1901 & 1913-18 & 1936-41 & 1953-58 & 1976-81 & 1993-98 & 2016-21 & 2033-38.



Without expert confirmation I must rely on statistical evaluations alone. Therefore I am reluctant to extend the 40-year cycle more than 75 years beyond the 200 years that have been meticulously recorded.

The 200-year span of heliocentric recordings confirms statistically the Mercury-Venus aspect cycle of 40 years. Determining the exact length of the cycle requires a solution of the N-body problem, which I will leave to someone with a better grasp of celestial mechanics. Nonetheless I believe the orbital period of Earth must be intertwined with harmonic behaviors of the two inner planets.

The era, 1776 to present, accompanies remarkable technological development. Intercity travel that once required horse-drawn carriages is now accomplished in high-speed trains or jet aircraft. People who once lived in small villages now dwell in sprawling metropolitan regions. Life expectancy has doubled wherever there is access to good nutrition and regular hygiene. Social customs have become more refined. Justice systems in prosperous nations have grown less corrupt and more complex. The volume of world trade has multiplied many times over, while personal expectations and attitudes have changed dramatically.

The 6-year Transitional periods are of special interest to historians.
Transitional periods of the 40-year cycle coincide with major
developments on many cultural levels.

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Recent History

Democracy, as we know it, is neither perfect nor complete. It has become more commonplace in recent times. A greater percentage of citizens are able to vote than 250 years ago. More nations hold free elections, and fewer of those exclude women or ethnic minorities from the electoral pageant.

No one likes to admit it, but present-day modernity has been patchworked together on the ruins of wars and revolutions. Old customs and attitudes haven't surrendered without a fight. Soldiers who risk their lives seldom grasp the true significance of what they're fighting for. Worse, they often suffer emotional hang-ups that remain long after the smoke clears.

That's why we need historians to make sense of the aftermaths, and then politicians willing to usher in those cultural changes without the penalties of war.

1776-1781 (American Revolution)

American Revolutionary War was waged between frontier colonists and absentee British overlords. The conflict began as a disagreement over arbitrary taxation and soon turned into a bitter struggle that lasted five years.

As soon as the revolution got underway, the French and Spanish saw an opportunity to challenge British naval supremacy. They began a siege to capture Gibraltar from the British garrison. When the siege failed, the French sent a naval fleet to the colonies. French vessels blocked the supply lines to the British expeditionary forces. This and the dogged resistance of the colonists forced the British to concede defeat.

The colonists formed a democratic republic with a constitutional government and a clever balance of powers that has stood the test of time. The constitution rejected the birthright entitlements of the old world and allowed citizens to succeed on merit before birthright. This signaled a major paradigm shift from Old World culture. In the following decades, millions of Europeans who were scapegoated at home would venture across the Atlantic to make a fresh start on a level playing field.

Technology: Developments included the inventions of the breech-loading rifle, threshing machine and circular saw. The world's 1st-bridge built entirely of cast iron was erected across the River Severn in Shropshire. Edward Gibbon published the first volume of *The History of the Decline and Fall of the Roman Empire*.

Discoveries: Captain James Cook, with ships HMS Resolution and HMS Discovery, visited Oahu then Kauai in the Hawaiian Islands of the Pacific Ocean, which he named the Sandwich Islands. Sir William Herschel discovered the planet Uranus.

Near (11 years)

1793-1798 (Consequences of the French Revolution)

European aristocrats watched in horror as heads rolled under the guillotine. For the monarchists, the French Revolution was a dangerous boil on the status quo. European governments exerted overt and covert influence in their efforts to set back the clock.

French Universal Conscription was decreed as follows: "The young men shall go to battle and the married men shall forge arms. The women shall make tents and clothes and shall serve in the hospitals; children shall tear rags into lint. The old men will be guided to the public places of the cities to kindle the courage of the young warriors and to preach the unity of the Republic and the hatred of kings."

Paul Barras and a young artillery officer (Napoleon Bonaparte) crushed the

Royalist riots in Paris. Britain, Russia and Austria formed the Alliance of St Petersburg against France. In the Battle of Lodi, Bonaparte defeated the Austrian rearguard at a bridge crossing the River Adda in Italy. Austrians were again defeated in the Battle of Bassano. Napoleon conquered Venice, ending the city's 1,100 years of independence. Napoleon landed troops in Egypt where he defeated the Marmelukes in the battle of Shubra Khit and captured Cairo. Napoleon again defeated Ottoman forces near the Pyramids.

Napoleon's brilliant military victories gave Frenchmen a sense of national pride. His troopers were promoted on the basis of merit. Common folk benefited from the new regime without realizing they had replaced one tyrant with another. On the upside, Napoleon encouraged scientists who gave the world a simple measuring system that was usable for beggars as well as the tutored gentry.

Russian General Alexander Suvorov stormed Warsaw in the war against the Polish uprising and captured Praha, killing many civilians.

The British Royal Navy began to carry lemon juice to prevent scurvy. Annual British iron production reached 125,000 tons.

Technology: Developments included the inventions of cotton gin, ball bearings and the hydraulic press.

Far (17 years)

1816-1821 (South American Liberation)

In the Battle of Chacabuco, the Argentine-Chilean patriotic army defeated the Spanish. The Pernambucan Revolt broke out in Brazil. Chile proclaimed its independence from Spain. Simón Bolívar defeated the Royalist Army in the Battle of Boyacá, and Colombia declared its independence from Spanish Monarchy. A revolt began in Santa María Chiquimula, Totonicapán department of Guatemala. In the Battle of Carabobo, Simón Bolívar won Venezuela's independence from Spain.

The nations of South and Central America became junior partners instead of

mere cash cows. However the plight of indigenous folk didn't change. They continued to labor for minimal wages at the mines and plantations of European immigrants.

The Ottoman government blamed Ecumenical Patriarch Gregory V of Constantinople for the Greek independence movement, and then hung him outside the main gate of the Patriarchal Cathedral. Greek rebels massacred 3,000 inhabitants of the city of Navarino. Afghans defeated a Persian invasion at the Battle of Kafir Qala.

Discoveries: An Imperial Russian Navy expedition led by Fabian Gottlieb von Bellingshausen and Mikhail Petrovich Lazarev sighted the coast of Antarctica. British Royal Navy captain Edward Bransfield landed on the mainland of Antarctica.

Technology: Robert Stirling patented his Stirling engine, then known as Stirling's air engine. A rail capable of supporting heavy locomotives was developed. The bicycle was invented in Europe. The Union Chain Bridge across the River Tweed opened between England and Scotland. Captain Samuel Brown designed a wrought-iron suspension bridge whose span of 137 meters was the world's longest vehicular bridge. Other technological developments included the electric telegraph and caffeine.

Near (11 years)

1833-1838 (Britain outlaws Slavery)

While the slave trade had been discouraged by European nations, slavery itself was still widely practiced until the Emancipation Bill passed British Parliament. A few years later, Trinidad became the 1st-British colony to grant freedom to former slaves.

Texas Revolution as follows: In the battle of Gonzales, Mexican soldiers tried to disarm the people of Gonzales, but they met stiff resistance from a hastily assembled militia. The Army of the Republic of Texas captured San Antonio. Mexican army defeated the rebels in siege of the Alamo. 342 Texan prisoners

were shot and killed in the Goliad Massacre. Then Sam Houston defeated General Santa Anna at San Jacinto, Texas. After this decisive victory, Sam Houston was elected the first president of the Texas Republic.

The Sixth Xhosa War involved severe clashes between white settlers and Bantu peoples in Cape Colony. Dutch-speaking settlers colonized the area north of Orange River.

Civil war erupted in Uruguay between supporters of Blanco and Colorado parties. An assassin tried to kill President Andrew Jackson in the United States Capitol. The first assassination attempt against a President of the United States.

Financial panic of 1837 began a lengthy economic slowdown in USA. Joshua Giddings of Ohio was the first abolitionist elected to US Congress. Transatlantic steamship service was established. People of the Cherokee Nation were forcibly relocated during the Trail of Tears.

Discoveries: HMS Beagle anchored off the Chonos Archipelago on the voyage of 1831–1836 with Charles Darwin.

Technology: Developments included the inventions of automatic revolving cylinder gun (Colt 45), telegraph, naval steam ram, steam shovel, combine harvester, electric motor and Charles Babbage's *Analytic Machine*, forerunner of the modern computer. Thomas Davenport installed his DC motor in a small model car, creating one of the first electric cars. Carl Friedrich Gauss and Wilhelm Weber obtained permission to build an electromagnetic telegraph in Göttingen. John Herschel discovered the open cluster of stars now known as NGC 3603.

Far (17 years)

1856-1861 (USA stumbles into Civil War)

The Second Opium War between several western powers and China began with the Arrow Incident on the Pearl River.

Indian rebellion of 1857: The 3rd-Light Cavalry of the British East India Company's rebelled against its British officers, thus beginning the rebellion.

Insurgents captured Delhi from the East India Company. British troops retook Lucknow. The last rebels of the Indian Mutiny surrendered in Gwalior.

Mahtra War: Peasants in the Estonian Governorate of Russian Empire revolted against serfdom, which had been officially abolished in 1816.

Panic of 1857: Speculation in US. railroad shares and collapse of the Ohio Life Insurance Company triggered a financial crisis which extended to Europe.

Slave labor raised many ethical questions and polarized two cultural traditions in the USA. Alarms were raised after John Brown's raid on Harper's Ferry and the split of Democratic Party into "northern" and "southern" wings, both of which led to the US Civil War.

South Carolina became the first state to secede from the United States Union. Jefferson Davis was elected as the Provisional President of the Confederate States of America. Fort Sumter surrendered to Southern forces. Confederate army defeated Union army at Manassas Junction in the First Battle of Bull Run. The USS San Jacinto stopped a British mail ship and arrested two Confederate envoys, sparking a diplomatic crisis between the UK and US. The British Empire established bases in Lagos, Portugal to stop the slave trade.

Technology: Developments included the inventions of the burglar alarm, magneto-electric lighthouse and the seismometer. Charles Darwin and Alfred Russel Wallace delivered papers on their theories of evolution to the Linnaean Society of London.

Near (11 years)

1873-1878 (Fossil-Fueled Trains & Factories)

The financial crisis of 1873 spawned widespread economic depression. Nations reacted by raising tariffs which only exasperated the problem. Greater numbers of the poor Europeans sought greener pastures in the "new" worlds of America and Australia.

Emancipation Day for Puerto Rico: Slaves were freed, with a few exceptions. After attaining independence, the Pacific island of Franceville became the first

self-governing nation to practice universal suffrage regardless of sex or race.

Carlist and Republican factions engaged in monthly battles, sieges and counter-sieges throughout the Spanish countryside. The Ottoman Empire declared partial bankruptcy and placed its finances in the hands of European creditors. The Russian Empire declared war on the Ottoman Empire.

In retaliation for the dramatic American defeat at the Battle of the Little Bighorn, United States Army troops under General Ranald S. Mackenzie sacked Chief Dull Knife's sleeping Cheyenne village at the headwaters of the Powder River; the soldiers destroyed the villagers' food and clothing, then slashed their ponies' throats.

Technology: Developments paved the way for the next century's adaptation of electricity. The inventions included barbed wire, electric candle, grain silo, four-stroke internal combustion (Otto cycle), the electric motor, hydrofoil craft, the tubular steel bridge, electric dental drill (battery powered), mimeograph and the telephone.

Far (17 years)

1896-1901 (Women Fight to Vote, Electric Age)

Nations fought over commercial turfs, including the Sino-Japanese War, the Boer War and the Boxer Rebellion. 10,000 Afghan and Orakzai tribesmen attacked a British outpost in northern Pakistan.

Spanish-American War: The United States Navy began a blockade of Cuban ports while the USS Nashville captured a Spanish merchant ship. Commodore Dewey destroyed the Spanish rescue squadron. After the Spanish-American War concluded, the Philippine-American War began when hostilities broke out in Manila.

American anarchist Leon Czolgosz shot US. President William McKinley at the Pan-American Exposition in Buffalo, New York. McKinley died eight days later.

The first modern Olympiad was staged in Athens. The British Parliament established the Commonwealth of Australia, a nation of castaways and criminals.

Madagascar proclaimed its citizens were free to choose a personal religion.

Carrie Chapman Catt succeeded Susan B. Anthony as president of the National Women's Suffrage Association. Women's groups yearned to join the public debate. When the crusades against obscenity began, feminists supported the formation of the American Puritan Alliance. In this case, their celebrity brought mixed results, for it reinforced the stereotype of women as silly fussbudgets.

Technology: Developments included the discovery of electrons and the inventions of solid rubber tires, 4-cylinder car motor, remote-controlled model boat, RDX (explosive), typewriter, tape-recorder, alkaline storage cells, photoelectric cell and reliable submarines. Nikola Tesla's alternating-current dynamos gained wide acceptance, replacing Edison's direct-current systems.

Near (11 years)

1913-1918 (Trench Warfare, Russian Revolution)

World War I (1914-18) was the bloodiest to date. Common soldiers in the trenches experienced atrocious conditions. At the conclusion of hostilities, the victors drew up vindictive peace arrangements that enforced financial hardships on the losers who would in two decades start another war.

Although the war affected few civilians directly, many more suffered from enforced rationing of common staples. Women had to do the jobs of men who were away on the battlefields. This experience would embolden women to demand the right to vote in the years following the debacle. Common soldiers began to question their highborn leaders. Socialism and shop unions would emerge after the war.

Russia fared badly in the WWI. Civil war in broke out between Reds (Bolsheviks) and Whites after the Czar was executed. Fair-minded idealists lost ground to hardline pragmatists. Much later with Stalin's consent, former Czarist autocrats weaseled into the revolutionary command structure. Russians found themselves oppressed by the same old gang spouting new slogans and sporting a new style of clothes.

Technology: Developments included the construction of Panama Canal and the inventions of the biplane, hydraulic hoist, stainless steel, assembly-line manufacturing, quantum theory, aluminum foil, multiprop heavy bomber, battle tank, water-cooled machinegun and mustard gas.

Far (17 years)

1936-1941 (Nazism & Fascism, WW2 Starts)

Chancellor of Germany for three years, Hitler used the Nuremburg Laws to scapegoat Jews and gypsies, and to establish a death camp at Dachau. Germany occupied the Rhineland, annexed Austria and tested German air power during Spanish civil war, then gobbled half of Czechoslovakia. Japan invaded China, while Italy broke ties with the League of Nations. Only the brain-dead could have missed the signs of war. But Europeans were still dazed from the last war and punch-drunk from years of financial crises and economic turmoil.

Germany invaded Poland, then surmounted the Maginot Line (using a surprise attack of twenty hang gliders), gobbled half of France and chased the British back to their island. By the end of 1941, German panzer divisions had advanced across Poland, France, the Balkans, North Africa and began a wholesale assault on Russia. Likewise, Japan had overrun Korea, Manchuria and much of China.

WW2 would cause far more havoc among civilians and noncombatants. Several cities were carpet-bombed to near extinction. National borders dissolved while the Axis empires grew and shrank. Nine million humans died in Germany's death camps. For many residents of Hiroshima and Nagasaki, death came in a blinding flash.

Meanwhile in the Indian subcontinent, Mahatma Gandhi was demonstrating the power of non-cooperation and peaceful resistance. Fresh from the successful Salt March, Gandhi exposed the hypocrisy of the British who held a tight rein on their colonial subjects while exhorting the same subjects to join the struggle against the Nazis. Gandhi was imprisoned during the war, but he was freed and

would live to see his homeland gain independence. His method of peaceful demonstration has been copied and emulated hundreds of times since: by Martin Luther King, by velvet revolutionaries, by the instigators of Arab Spring. The “Occupy Wall Street” movement follows the same script. Peaceful gatherings in public spaces have become the most productive means to garner wide-spread support against social injustices.

Technology: Developments during WW2 inspired rampant consumerism in the years afterward. The inventions included VHF television, vinyl polymers, electro-mechanical calculator, jet engine, helicopter, offshore oil well, radio telescope, pressurized high-altitude airliner, ejection seat, fluorescent lighting, color television, nuclear fission, nylon stockings, DDT and FM radio.

Near (11 years)

1953-1958 (Television Brings Home the World)

USA emerged from WWII with 90% of the world's wealth. Wisely it aided the global recovery efforts of both allies and opponents, including Germany and Japan. Europeans surprised everyone when their governments, which had been at each other's throats for 1,500 years, agreed to share a common market for coal and steel, and later agreed to cut out most trade barriers.

The standoff (East against West) at the Korean DMZ symbolized the state of global politics. Red China had shrugged off the last vestiges of Western meddling and emerged as USSR's junior partner. The development of atomic warheads aka hydrogen bombs presented military strategists with a thorny dilemma. An escalated nuclear exchange threatened to destroy global civilization, so MAD (Mutually Assured Destruction) became the mantra of the times. East and West squared off nose-to-nose in what was dubbed the Cold War.

The fledging UN survived its 1st-test as a forum of peace and diplomacy, while the new media of television showed the dramatic images of important global events to viewers in developed countries. Despite or because of the looming specter of nuclear holocaust, consumers rushed out to buy the latest

gizmos. The middle class sped along fast tracks of optimism and bought laborsaving devices by the truckload.

Technology: Developments included the discoveries of DNA and RNA as well as the inventions of nuclear-powered submarines, human growth hormone, transistor radios, computer memory, hovercraft, air-to-air guided missiles, transoceanic telephone cables, ultrasound, polio vaccine, Sputnik (paving the road for comsats), rotary-blade lawnmower and the hula-hoop.

Rocket-like fins on Detroit's automobiles lampooned the dawn of the Space Age.

Far (17 years)

USA and Russia raced to be the first to send a man to the moon. NASA won and then aborted its lunar exploration program.

1976-1981 (Integrated Circuits & InfoTech)

The Green Revolution in agriculture encouraged farmers around the world to buy fertilizer, pesticides and high-yield seeds. The proponents of "progressive" monoculture promised endless increases in crop yields. Fishers around the world utilized better nets and winches and caught fish in record numbers. Consumers of developed nations thrived amidst a cornucopia of conveniences. They expected a future of unlimited abundance.

Meanwhile, the largest oil providers formed the OPEC cartel. OPEC limited production levels, which led to dramatic rises in oil prices that in turn bred runaway monetary inflation. Western leaders bemoaned the "take-no-prisoners" approach of the Middle East oil barons. Consumers were forced to rely on credit to save face and keep pace.

In China the Gang of Four was ousted. The new leadership embraced science and technology, setting the country on the road to becoming a major economic power. Iraqi troops crossed the Iranian border and began the Iraq-Iran War. Soviets launched a full-scale invasion of Afghanistan.

Supertankers ran aground in the Atlantic and Gulf of Mexico, spreading lethal

oil slicks. Scientists began to document the hazardous effects of pollution in the environment. Social pundits warned that population growth could result in shortages for both rich and poor.

The Supreme Court of the USA ruled that blacks and other minorities would be entitled to retroactive job seniority. "Liberated" women demanded equal status, equal leverage and free choice regarding childbirth. Their struggle set off a controversy that continues to the present.

Technology: Developments included the inventions of solar-powered boats, supercomputers, neutron bombs, the space shuttle (reusable LEO orbiter), telephonic fiberoptic cables, ABS brakes, electronic typewriters, maglev high-speed trains, test-tube babies, satellite navigator (prototype GPS), CMOS (modern computer architecture) and Dolby sound systems. NTT launched a fully automated cellular network for commercial usage in Japan.

Near (11 years)

1993-1998 (Internet, World Wide Web, Social Media)

Microsoft's introduction of Windows 95 made personal computers a viable option for the majority of non-geek consumers. Commercial vendors discovered the marketing possibilities of the World Wide Web. This enterprise was aided and abetted by the advent of Digital Versatile Discs (DVD), high-capacity Hard Drives, Liquid Crystal Displays, fiberoptic modems with superfast online access.

The global haul of fish from the oceans reached its peak and then began a gradual decline. Higher costs of fertilizers and overuse of fresh water reserves slowed the gains in agriculture production. World feedstocks shrank while hungry mouths continued to multiply. Misguided policies to grow crops for fuel gave cars more priority than 3rd-world hunger.

Communications (via the Internet and comsats) furnished instant reportage of events anywhere on the planet. Social networking via online forums would lead to global nexuses such as Facebook and Twitter, and instant text-messaging polls.

This didn't stop tyrants from abusing their citizens, but it brought human rights' violations into the open for the world community to scrutinize. Unfortunately, sympathy proved cheaper than direct intervention. The UN commanded no standing army and was obliged to ask member nations for troops and equipment. Hence, the world community sat on its hands while 800,000 Tutsis and their Hutu sympathizers were hacked to death in a frenzied display of genocide. UN diplomats contended themselves with sending formal protests to the power-mad rulers of Myanmar, Sudan, North Korea, Zimbabwe, Somalia and elsewhere. Taliban marched into Kabul and brought 90% of Afghanistan under its control.

Technology: The world community limited the use of aerosols that were depleting the O-zone layer. However, the damage was long-term, and WHO warned of more casualties from eye damage and skin cancer. Europeans launched the European Community (EC) and made plans to admit former East-Block nations. Astronomers thanked their lucky stars, for the Galileo spacecraft was well positioned to watch the comet Shoemaker-Levy 9 crash into the Jovian atmosphere. Cassini-Huygens was launched from earth on a 7-year interplanetary voyage to Saturn.

Far (17 years)

Summary [*See Endnote #4*]

The Transitional periods coincide with many pivotal events over the past 225 years. The span covers a wealth of scientific discoveries and technological wonders. The social changes include longer lifespans and greater creature comforts. Democracy has progressed from a fledgling idea to a regular pageant. Laws have multiplied and grown evermore complex. In order to participate in contemporary society, youngsters need specialized skills beyond simple literacy and common sense arithmetic. Hence, education has become synonymous with

classroom curriculums that run circles around the clumsy efforts of parents. Travel has gone from hiking and horseback to comfy seats on high-speed trains, aboard jet airplanes and via cars speeding across asphalt roadways.

Folks enjoy longer and healthier lives with leisure opportunities galore. Yet only one-third of the world's population has access to the latest conveniences and techno windfalls. Another one-third strives like mad to achieve parity, while the rest grasp for a few hand-me-downs and little else. Climate change has turned once-fertile fields into parched deserts. Many 3rd-world farmers are worse off than they were 100 years ago. In desperation, they've become the influx of rural folks into overcrowded cities.

New modes of media have brought the world into everyone's den. Yet I wonder how the subsistence farmers of Malawi feel when they see the reruns of North American sitcoms. They must feel like beggars, their noses pressed outside the glass windows of five-star restaurants.

Everyone hopes to stay in sync with the prevailing culture, but underlying truths are lost in the media hoopla. Folks seldom anticipate the next war until soldiers begin marching in lockstep.

Folks receive steady influxes global news via the plethora of media links. But witnessing from afar and experiencing firsthand are not the same. Too often, people feel powerless to influence newsworthy events. They feel disconnected from political leaders who should be taking decisive actions. Individuals may debate the complexities of global policies, but they have little meaningful sway in the outcomes. Personal input is unwelcome when democratic governments scale up to service millions or billions. Layers of hierarchy and channeled detours

(aka voicemail and helpdesks) make it difficult, if not impossible, for someone on the ground floor to connect with anyone at the top.

The lulling effect of commercial media only exasperates individual alienation. With TV remotes in hand, folks are immune to the opinions and calamities of others. Political debate has become more of a catfight than a vital exercise. The candidates' remedies seldom go beyond trivial concerns and familiar clichés. Disregard for things foreign or alien epitomizes the silent majority. "Not in my backyard" has become the common refrain.

More disturbing, competition among vendors doesn't always serve the best interests of consumers. A handful of providers hawk wares that are essentially identical and often mediocre. Disposable throwaways consume energy and then bloat the transient dumpsites. The long-term consequences are hidden amidst the tidal wave of ad campaigns that encourage short-term convenience and ignore true functionality or durability.

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Way-Back History

The significance of cultural change becomes clearer as we look back farther in time. Folks who live in the present must choose among a host of competing ideas without knowing which will prove successful in the long run. Historians have the bonus of hindsight. They know beforehand which socioeconomic policies will survive the test of time. They can focus on the “winners” of any given epoch. “Winners” tend to stand out with greater clarity, while “losers” fade into the background noise.

To extend the 40-year Cycle to the distant past, the author has assumed its length to be 14,600 days and this duration to neither expand nor contract over the centuries. For instance, if one 40-year Cycle begins on January 1st, 1500, it will end on December 22nd, 1539. Over a period of 1,461 years, the 40-year Cycle will have slipped all the way around the annual calendar and began once again on January 1st. However, only 1,460 years will have passed in chronological reckoning.

Meanwhile, the dates of events grow evermore hazy as we scrutinize the distant past. Conflicts may continue for more than a single campaign season. Historians often disagree as to the exact day or month of births or deaths, decisive battles, palace rebellions or coronations. So the author has grouped all events by year of occurrence, regardless of the day or month they may have happened. Around 1000 AD., the author has shifted the 40-Year Cycle over one year. Another year disappears for events on the B.C. side of the timeline, because the year zero was ignored when early Christians

rewound their calendar. [See Endnote #4]

Renaissance (1456-1775)

European Exploration: After an entire millennium, Europeans are recovering the savvy and creature comforts that were lost at the fall of the Roman Empire. Trade with the Muslim cultures of North Africa and the Middle East is a big reason for this recovery. Europeans feel secure in their homelands and look outward for new challenges beyond their horizons.

The Italian merchants of Venice and Genoa have grown wealthy with trade across the Mediterranean Sea. The Portuguese are exploring new markets along the western coast of Africa. The Spanish will strike new ground as they sail west and discover the western hemisphere. Before long the British and Dutch will summon their Viking heritage and become Europe's premier shipwrights. So the race begins to find and claim new lands for personal fame and homeland glory.

Long voyages beyond the sight of land require new technologies. Explorers soon realize there is a constant need for more and better tools. As the explorers grow bolder, the demand for new technologies increases. All the while, explorers return with exotic tales, strange new foods like potatoes, corn and tasty spices, new drugs like tobacco and opium, new commodities like gold, silver, elephant ivory, snow-white polar bear pelts, balsa wood, etc.

Stay-at-home Europeans remain skeptical when they hear the exotic tales from returning explorers, but the seeds of change are planted nonetheless. Peasants don't fancy being chained to their fields when

opportunities abound among the growing merchant class. As if the explorer's bug is contagious, young folk risk their lives on dangerous voyages to the western hemisphere, to Australia or the Orient, where they can make a fresh start.

Technological innovations encourage more explorations, which in turn breed social changes.

Transition Period (1456-1461)

Muslims: The Turks conquer Athens and issue a decree to protect the Acropolis.

In the 2nd-Battle of Oronichea, Ottoman forces of 15,000 march into Albania where they are defeated by Skanderbeg's smaller force. The Battle of Ujëbardha is one of Skanderbeg's most important victories against the Ottoman army in the open field.

The Empire of Trebizond: The last major Romano-Greek outpost on the south shore of the Black Sea falls to the Ottoman Empire under Mehmed II, after a 21-day siege.

Europe: Battle of Nándorfehérvár (Belgrade): Hungarians under John Hunyadi rout the Ottoman army of Sultan Mehmed II, the conqueror of Constantinople. Pope Callixtus III orders a noon bell to commemorate the victory throughout the Christian world.

Battle of Towton: Edward IV routs Queen Margaret's army to make good his claim to the English throne. It is considered the bloodiest battle ever fought in England.

China: The Ming Dynasty, military general Cao Qin stages a coup against the Tianshun Emperor. He sets fire to the eastern and western gates of the Imperial City (Beijing), which are doused by pouring rains during the daylong uprising. Cao Qin finds himself hemmed in on all sides by imperial forces, loses three of his own brothers in the fight. Instead of facing execution he flees to his home in the city and commits suicide by jumping down a well inside his walled compound.

Near (11 years)

Transition Period (1473-1478)

Muslims: Ottoman Sultan Mehmed II, the conqueror of Constantinople, defeats the White Sheep Turkmens led by Uzun Hasan at Otlukbeli. In the battle of Vaslui, Stephen III of Moldavia defeats the Ottoman forces of Mehmed II. In the battle of Valea Albă, Mehmed II gets the best of the Moldavians.

Europe: The Catholic Inquisition in Spain begins, accompanied by brutal torture and flagrant injustice.

Technology: Music, maps and posters are printed mechanically.

Far (17 years)

Christopher Columbus reaches West Indies in 1492

Transition Period (1496-1501)

North America: Columbus leaves Hispaniola for Spain, ending his 2nd-visit to the Western Hemisphere. During his time here, he has forcibly subjugated the island, enslaved the Amerindians and laid the basis for a system of land grants tied to the Amerindians' labor service.

Europe: First Battle of Lepanto: The Turkish navy wins a decisive victory over the Venetians.

Technology: Leonardo da Vinci unsuccessfully tests a flying machine. He finishes painting The Last Supper on the refectory wall of Santa Maria delle Grazie in Milan. Michelangelo returns to his native Florence and begins work on the statue David.

Technological developments: toothbrushes are used in China; Jacob Nufer of Switzerland performs a successful a Cæsarian section on his wife.

Near (11 years)

Transition Period (1513-1518)

Europe: In the battle of Novara: Swiss troops defeat the French under Louis de la Tremoille, forcing the French to abandon Milan. Duke Massimiliano Sforza is restored. Battle of Orsha: The Belarusians and Poles defeat the Russian army in one of the biggest battles of the century.

Muslims: In the battle of Chaldiran, Selim I crushes the Persian army of Shah Ismail I. Then he declares war on the Mameluks and invades Syria. In the battle of Yaunis Khan, Ottoman forces under the Grand Vizier Sinan Pasha defeat the Mameluks near Gaza. Battle of Ridaniya: Turkish forces of Selim I defeat the main Mamluk army under Touman Bey.

China: Portuguese merchant Fernao Pires de Andrade meets Ming Dynasty officials at the Pearl River estuary. Fernao lands in the jurisdiction of Hong Kong.

Technological Developments: Johannes Schöner produces his 1st-globe. Europeans explore the Río de la Plata when Spanish navigator Juan Díaz de Solís traverses it during his search for a passage between the Atlantic and Pacific Oceans. Martin Fernandez de Enciso publishes his *Suma de Geographie* in Castile, a summary of world geography incorporating the latest discoveries in the New World.

Far (17 years)

Transition Period (1536-1541)

Europe: War resumes between Francis I of France and Charles V, the Holy Roman Emperor. Francis relinquishes control of Savoy and captures Turin. Charles enters Rome in victory on the Via Triumphalis and delivers a speech before the pope and College of Cardinals publicly challenging the king of France to a duel.

Africa: Battle of Preveza: The Turkish fleet under the command of Barbarossa Hayreddin Pasha defeats the Holy League fleet under the command of Andrea Doria. The fleet of Barbary pirate Ali Hamet (a Sardinian in league with the Ottoman Empire) sacks Gibraltar. Many of its leading citizens are taken as

captives to Morocco.

North America: Spanish explorer Hernando de Soto introduces pigs into North America when he lands in Florida and journeys to the Mississippi River. Spaniards bring the potato to Europe.

Technology: Work begins on the Piazza del Campidoglio (Capitoline Hill), designed by Michelangelo. Pope Paul III moves the Equestrian Statue of Marcus Aurelius to the Capitoline Hill. Jean Ruelle publishes *De Natura stirpium libri tres* in Paris, the first general descriptive botany to be printed. Niccolò Fontana Tartaglia publishes *La Nova Scientia* in Venice, applying mathematics to the study of ballistics.

Near (11 years)

Transition Period (1553-1558)

India: Second Battle of Panipat: Fifty miles north of Delhi, a Mogul Army defeats Hindu forces of General Hemu, to ensure Akbar the throne of India.

South America: Arauco War. Battle of Mataquito in present-day Chile: Spanish forces of the Governor Francisco de Villagra launch a dawn surprise attack against the Mapuche headed by their toqui Lautaro.

Europe: Pope Paul IV creates the first Jewish ghetto in Rome.

Battle of St. Quentin: the Spanish and English under Duke Emanuel Philibert of Savoy decisively defeat French forces under Marshal Anne de Montmorency. Montmorency himself is captured, but the victors refuse to press their advantage and withdraw to the Netherlands.

Nature; The Shaanxi Earthquake of 1556, the deadliest earthquake in history, occurs with its epicenter in Shaanxi province, China; 830,000 people may have been killed.

Technological developments: sealing wax (including shellac), equals sign “=”, enamels.

Far (17 years)

Transition Period (1576-1581)

Europe: Francis Drake leaves Plymouth, England, aboard the Pelican accompanied by four other ships on an expedition against the Spanish along the Pacific coast of the Americas, which will become a circumnavigation.

Battle of Gembloix: Spanish forces under Don John of Austria and Alexander Farnese defeat the Dutch. Alexander Farnese begins to recover control of the French-speaking Southern Netherlands.

Africa: Battle of Al Kasr al Kebir: The Moors defeat the Portuguese. King Sebastian I of Portugal is defeated and killed in North Africa, leaving his elderly uncle, Cardinal Henry, as his heir. This initiates a succession crisis in Portugal.

Technology: Norman Diggs fashions a magnetic needle dip. Tycho Brahe opens *Uraniborg* observatory. Galileo investigates pendulum motion.

Near (11 years)

Rough seas and swifter English ships defeat the great Spanish Armada, 1588.

Transition Period (1593-1598)

Europe: Battle of Calugareni: The Wallachians, led by Michael the Brave, accomplish a great victory against the vast army of the Turks, numbering over 150,000 men, led by Sinan Pasha. It is a Wallachian tactical victory. In the Battle of Giurgiu, Michael the Brave again defeats the Turkish army led by Sinan Pasha, pushing them on the south side of the Danube.

Technological developments: Gerhard Kremer, a Flemish mathematician, fashions a map atlas.

Far (17 years)

Transition Period (1616-1621)

China: Battle of Sarhu: Manchu leader Nurhaci is victorious over the Ming forces. **Battle of Cecora:** The Ottoman Empire defeats Polish-Lithuanian Commonwealth–Moldavian troops.

Europe: Thirty Years' War – Battle of Věstonice: Bohemian forces defeat the Austrians. Battle of Humenné: Polish troops assist the Holy Roman Emperor by defeating a Transylvanian force, forcing Gabor Bethlen to raise his siege of Vienna. 27 Czech lords are executed on the Old Town Square in Prague as a consequence of the Battle of White Mountain.

Technological developments: William Oughtred devises a rectilinear slide-rule. The modern violin is developed.

Nicolaus Copernicus' *De revolutionibus orbium coelestium* (1543) is placed on the Index of Forbidden Books by the Congregation of the Index of the Roman Catholic Church until corrected. Galileo Galilei meets Pope Paul V in person, to discuss his position as a defender of Copernicus' heliocentrism.

Kepler unveils three Laws of Planetary Motion. His equation [$M = E - e * \sin(E)$] remains a valuable tool for evaluating elliptic orbits. Kepler will die as collateral damage during the Thirty Years War.

Near (11 years)

Transition Period (1633-1638)

Europe: Battle of Smolensk: King Ladislaus IV of Poland defeats the Russian army. Spanish troops under Ferdinand of Austria defeat a much larger Dutch force near Antwerp at the Battle of Kallo during the Eighty Years War.

China: Admiral Weddell undertakes the first English venture to China when he sails into port in Macau and Canton during the late Ming Dynasty. English trade ventures break regional domination by Portuguese and Spanish. Six European ships dock at a port in China, bringing 38,421 pairs of eyeglasses to China during the late Ming Dynasty, the first recorded European-made eyeglasses to enter China.

Technology: Chinese encyclopedist, Song Yingxing, publishes his *Tiangong Kaiwu* (Exploitation of the Works of Nature), considered one of the most valuable encyclopedias of classical China.

The Roman Catholic church forces Galileo Galilei to recant his heliocentric

view of the solar system.

Far (17 years)

Transition Period (1656-1661)

Europe: Anglo-Spanish War: France and England form an alliance against Spain. Battle of the Dunes: A Spanish force tries to lift a siege of Dunkirk, but French and English defeat the would-be rescuers. England is then given Dunkirk for its assistance in the victory.

Russo-Swedish War: At conclusion, Russia surrenders to Sweden all captured territories. Battle of the Lines of Elvas: The Portuguese beat the Spanish in the Portuguese Restoration War.

China: Sarhuda's Manchu fleet annihilates Onufriy Stepanov's Russian flotilla on the Amur.

Technological developments: Robert Boyle publishes *New Experiments Physico-Mechanicall, Touching the Spring of the Air and its Effects*. The 2nd-edition in 1662 will contain Boyle's Law. Christiaan Huygens files a patent and makes use of pendulums for more accurate clocks. Gregor Mendel starts his research on genetics. William Herschel initiates fingerprinting in Bengal as a means of identification.

Near (11 years)

Transition Period (1673-1678)

Europe: First Battle of Schooneveld: The sea battle of the Third Anglo-Dutch War is fought off the Netherlands coast. The Dutch win with the fleet of the United Provinces (commanded by Michiel de Ruyter) against the allied Anglo-French fleet commanded by Prince Rupert of the Rhine. Second Battle of Schooneveld: The Dutch fleet again defeats the Anglo-French fleet.

Polish and Lithuanian military units under the command of soon-to-be-king Jan Sobieski defeat the Turkish army in the Battle of Khotyn. In this battle,

rockets of Kazimierz Siemienowicz are successfully used. The Russo-Turkish War (1676–1681) begins.

Battle of Landskrona: Sweden defeats the Danes.

North America: Metacomet, known as “King Philip” and leader of the Algonquian tribe of Wampanoag, travels westward to the Mohawk nation, seeking an alliance with the Mohawks against the English colonists of New England; his efforts to forge an alliance end in failure. Shortly after, Major John Talcott sweeps Connecticut and Rhode Island, captures large numbers of Algonquians and exports them out of the Thirteen Colonies as slaves.

Technological developments: Robert Hooke devises a universal joint to manipulate his helioscope to observe the sun safely.

Far (17 years)

Transition Period (1696-1701)

Europe: Battle of Zenta: Prince Eugene of Savoy crushes the Ottoman army of Mustafa II and effectively ends Turkish hopes of recovering lost ground in Hungary. The Manchu of the Qing Dynasty conquers Outer Mongolia. Lithuanian Civil War: Battle of Olkieniki results in victory for the anti-Sapieha coalition.

The Great Northern War: Denmark and Poland-Saxony invade Swedish territory in Germany and Latvia. Sweden has control of the Baltic Sea and holds territory that includes Finland, Estonia, Latvia and parts of northern Germany. To challenge Swedish power, an alliance is formed between Tsar Peter I of Russia, King Frederick IV of Denmark and Augustus II the Strong, King of Poland and Elector of Saxony. Sweden's ruler is the militaristic Charles XII, known as the *Swedish Meteor*.

Technology: Inflated girdle, steam-powered mining pump, portable fire-hose pump are being used. Christiaan Huygens, in his posthumously published book *Kosmotheoros*, argues that other planets in the solar system could contain extraterrestrial life, starting a debate that extends into the 21st-century.

Near (11 years)

Technology: Denis Papon toys with an experimental steam engine. Bank notes and Epsom salts are introduced.

Transition Period (1713-1718)

Europe: Second Treaty of Utrecht between Britain and France ends the War of the Spanish Succession. France cedes Newfoundland, Acadia, Hudson Bay and St. Kitts to Britain. Battle of Gangut: The Russian Navy gains its first important victory.

Battle of Petrovaradin: 83,300 Austrian troops of Prince Eugene of Savoy defeat 150,000 Ottoman Turks under Damad Ali Pasha. France declares war on Spain, leading to the two-year War of the Quadruple Alliance.

Technological developments: James Puckle develops a prototype repeating gun. The chambers are flintlock loaded. Seven chambers fire 63 times in seven minutes.

Far (17 years)

Transition Period (1736-1741)

North America: Battle of Ackia: British and Chickasaw Native Americans defeat French troops.

Europe: Russo-Turkish War: Russian forces under Field Marshal Munnich storm the Ottoman fortress of Ochakov and take 4,000 Turks prisoner; Austria enters the Russo-Turkish War. The Treaty of Belgrade brings the Russo-Turkish War to an end. Frederick II of Prussia invades the Habsburg holdings in Silesia, starting the War of the Austrian Succession.

Java: Batavia massacre: Troops of the Dutch East India Company massacre 5,000–10,000 Chinese Indonesians in Batavia.

Explorations and Inventions: Vitus Bering, a Dane hired by Russia, “discovers” Alaska. Philippe Buache draws 1st-map with contour lines. Charles Valoue builds pile-driving machine. Benjamin Martin fashions pocket-sized microscope.

Near (11 years)

Transition Period (1753-1758)

Europe: Seven Years' War begins as Britain and Prussia contend against France, Spain, Austria and Russia. This war will expose national holdings in North America, Asia and Africa. British commander, Robert Clive, defeats Nawwab of Bengal. This marks the beginning of British rule in India.

Nature; Earthquake hits Lisbon, Portugal. Over 60,000 deaths.

Technology: Samuel Johnson's *Dictionary* first published; Friedrich van Knauss develops a clunky prototype of the modern typewriter; Procopius Divis conducts experiments with a lightening conductor. M. Garvin designs an iron-girded bridge; William Cookworthy finds high-quality "kaolin" clay, which makes excellent porcelain. Joseph Black, a chemist, isolates carbon dioxide; Captain John Campbell designs a sextant that greatly improves a seaman's ability to acquire astronomical bearings; John Dollond builds the first achromatic refractor telescope.

Far (1759-1775)

China experiences an era of great prosperity. Its population is growing rapidly, doubling in less than 70 years.

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European Dark Ages (496-1455)

Western Europe occupied by squabbling barbarian invaders. Peaceful trade routes, road maintenance, postal services all disintegrate. Civil authority devolves to local warlords. Personal hygiene is neglected, and illiteracy becomes the norm.

I find nothing of cultural value happening in Europe. China plods through its dynastic cycles. Confucian bureaucrats keep society from falling into total chaos, and new blood rises to fill the voids of decadence. In the Middle East, Arabs are rediscovering and readapting Greco-Roman culture. In the Western Hemisphere, Mayan cultures rise and fall.

Societies are divided into four classes: clerics, warriors, merchants and farmers. A minority of oligarchs ride herd on everyone else. I don't see significant changes from this mold, so I refrain from noting the brush wars and contemporary gossip.

Transition Period (497-502)

Near (11 years)

Transition Period (514-519)

Far (17 years)

India: Aryabhata and Varamihara (mathematicians) introduce the decimal system.

Transition Period (537-542)

Near (11 years)

Transition Period (554-459)

Far (17 years)

Transition Period (577-582)

Iron-chain suspension bridge is constructed in China.

Near (11 years)

Transition Period (594-597)

Far (17 years)

Transition Period (617-622)

Porcelain vessels are introduced in China.

Near (11 years)

Transition Period (634-639)

Muslims: Arab armies invade Syria and Iraq. Khalid Ibn Walid captures Damascus. In engagements along the Yarmouk River, Muslim forces of the Rashidun Caliphate (led by Khalid ibn al-Walid) defeat the armies of the Eastern Roman-Byzantine Empire, completing the Muslim conquest of Syria. Called the battle of Yarmouk, it is deemed one of the most decisive in military history. Rashidun Caliphate takes the Persian capital of Ctesiphon then conquers Jerusalem, Aleppo and Antioch (Antakya).

China: Tang Dynasty: Emperor Taizong invades the Xianbei/Tibetan state of Tuyuhun. Tang commander Li Jing crushes the Tuyuhun forces, which results in the assassination of their leader (Busabuo Khan Murong Fuyun) and the dissolving of their state. Emperor Taizong's campaign against Tufan results in the marriage alliance between the Tang Dynasty and the Tibetan Empire, as the Chinese Princess Wencheng is wed to Tibetan ruler Songtsän Gampo.

The Chinese historian Yao Silian completes the Book of *Liang*.

Far (17 years)

First windmill used in Persia to grind wheat.

Transition Period (657-662)

Muslims: The Battle of the Camel between Ali and Aisha, part of the first civil war in Islam, takes place in present-day Basra, Iraq. Caliph Ali ibn Abi Talib is assassinated; with his assassination the Rashidun Caliphate ends and Muawiyah I founds the Umayyad caliphate.

Technology: Emperor Gaozong of Tang commissions the pharmacology publication of an official *materia medica*, which documents 833 different substances taken from various stones, minerals, metals, plants, herbs, animals, vegetables, fruits and cereal crops used for medicinal purposes. The Tang Dynasty Chinese Buddhist monks and engineers Zhi Yu and Zhi You recreate several South-Pointing Chariots for the Japanese Emperor Tenji. This is a 3rd-century device originally made by Ma Jun that acts as a mechanical-driven directional-compass vehicle.

Near (11 years)

Transition Period (674-679)

Muslims: The first Arab siege of Constantinople begins and lasts four years before the Arab besiegers withdraw in defeat.

Far (17 years)

Transition Period (697-702)

Muslims: Arabs under Hassan ibn al-Nu'man capture Carthage from the Byzantine Empire, and destroy it completely. The defeated Byzantine fleet revolts and proclaims Tiberius III who deposes Leontius. After a brief siege of Constantinople, Tiberius III becomes Byzantine Emperor. Musa bin Nusair defeats the Berber army in Algeria, ending resistance against the Arabs there. The Umayyad prince Abdallah ibn Abd al-Malik captures the Byzantine stronghold of Theodosiopolis.

Muhammad ibn Marwan invades the Byzantine Armenian provinces east of the Euphrates; the local commander Baanes surrenders before the large Arab army and the population accepts a Muslim governor.

Technology: Fine porcelain vessels are used and will become the highly valued artifacts of the Chinese Tang dynasty. Buddhist influences from India have merged with Chinese social practices.

Near (11 years)

Transition Period (714-719)

China: Emperor Xuanzong of Tang starts to rule. He liquidates the highly lucrative *Inexhaustible Treasury*, which is run by a prominent Buddhist monastery in Chang'an. This monastery collects vast amounts of money, silk, and treasures through multitudes of rich people's repents, left on the premises anonymously. Although the monastery is generous in donations, Emperor Xuanzong issues a decree abolishing their treasury on the grounds that their banking practices were fraudulent, collects their riches and distributes the wealth to various other Buddhist monasteries, Daoist abbeys. These funds are used to repair statues, halls and bridges in the city.

Muslims: Seville and Mérida fall to the Arab armies of Musa bin Nusair. The

Umayyads conquer Lisbon. Maslamah ibn Abd al-Malik begins the 2nd-Arab siege of Constantinople, which will last for nearly a year. Battle of Covadonga marks the start of the *Reconquista* by a Christian military force (under Pelagius of Asturias) of the Iberian Peninsula, following the Umayyad conquest of Hispania.

Damascus flourishes as the center of Muslim culture, and the earliest Islamic paintings appear. Caliph Omar II grants tax exemptions to all Muslim believers.

Far (17 years)

Transition Period (737-742)

Europe: Battle of Avignon: The Frankish army under Charles Martel expels Umayyad forces from the city. Battle of Narbonne: The Frankish army defeats the Umayyad forces but fails to retake the city. Battle of Nîmes: The Frankish army expels Umayyad forces from the city and destroys it.

Muslims: Thawra revolt in Tanger against the Umayyad rulers. The movement is led by a humble water carrier, Maysara, against the decision to levy the same taxes upon the newly converted Muslims and the non-Muslims. Maysara declares himself caliph and rules the city brutally. He is soon replaced by a rival, Khâlid al-Zanâti. The revolt spreads rapidly to the region and the rebellious areas adopt the Kharijite movement of Islam against the Umayyad Sunnis.

The Umayyad caliphate of Syria sends a 4th-expedition to crush the rebellion in the Atlas region. They are defeated in the plain of the Ghrab (Morocco). The counterattack of the Kharijite rebels to the East is successful but fails to conquer Kairouan from the loyalists. A more radical branch of the Tunisian Kharijites, the Sofrists, manages to take the city soon after.

Byzantium: Battle of Akroinon in Anatolia (west-central Turkey) results in significant Byzantine victory over the Umayyads and halts the impetus of Arab attacks into Anatolia.

Mesoamerica: The powerful Mayan city-state Xukpi (Copán) is defeated by a rival city-state, Quiriguá. Xukpi leader Uaxaclajuun Ub'aah K'awiil (Eighteen

Rabbit) is deposed thereafter.

Near (11 years)

Transition Period (754-759)

Europe: The Franks capture Narbonne; the Saracens are completely driven out of France.

China: Emperor Suzong of Tang ascends to the throne, after his father Emperor Xuanzong abdicates while fleeing to Sichuan during the An Lushan rebellion. The Tang army, led by Zhang Xun, wins the Battle of Yongqiu.

Far (17 years)

Transition Period (777-782)

Europe: Battle of Roncevaux Pass (Roncesvalles): Charlemagne's army suffers a terrible defeat at the hand of the Basques. Among those killed is Roland, lord of the Breton March; the 11th-century Song of Roland is loosely based on the events of this battle. Charlemagne continues to fight Moors in Spain.

Near (11 years)

Transition Period (794-799)

Far (17 years)

Transition Period (817-822)

Byzantium: General Thomas the Slav secures control over most of Byzantine Anatolia (west-central Turkey) and gains recognition from the Abbasid Caliphate. Thomas crosses over into Europe where the emperor Michael II is blockaded in Constantinople, but Thomas' first attack on the city fails.

Math: Muslim mathematician Muhammad ibn Mūsā al-Kwārizmī founds

algebra.

Near (11 years)

Transition Period (834-839)

Byzantium: The emperor Theophilos is badly defeated at the Battle of Anzen by the Abbasids. Caliph al-Mu'tasim then proceeds to capture and raze Amorium (near Cakmak, Turkey), the native city of the Byzantine Empire's reigning Amorian dynasty.

Technology: The construction of Mosque of Uqba (Kairouan, Tunisia) begins.

Far (17 years)

Transition Period (857-862)

China: An enormous flood along the Grand Canal of China inundates large tracts of the North China Plain, killing tens of thousands of people and adding to the further decline of the Tang Dynasty.

Africa: The University of Al Karaouine is founded in Fes, Morocco (recognized by the Guinness Book of World Records as the oldest university in the world).

Near (11 years)

Transition Period (874-879)

China: A widespread failure of the agricultural harvest in Tang Dynasty China leads to a widespread famine; in the previous century the central government was able to curb famine with large grain stores, but this time the central government is already in decline and too weak to properly face the disaster.

Muslims: After a siege of eight months, Syracuse is captured by the Aghlabids of Ifriqiya. The construction of Mosque of Uqba (Kairouan, Tunisia) is completed.

Far (17 years)

Transition Period (897-902)

Technology: The Persian scientist Rhazes distinguishes smallpox from measles in the course of his writings. Holding against any sort of orthodoxy, particularly Aristotle's physics, he maintains *the conception of an "absolute" time as a never-ending flow.*

Concave plow (curved-iron moldboard) first used in China.

Near (11 years)

Transition Period (914-919)

Far (17 years)

Transition Period (937-942)

Near (11 years)

Transition Period (954-959)

Far (17 years)

Transition Period (977-982)

China: Zhang Sixun, a Chinese astronomer and engineer, employs the use of liquid mercury in order for the escapement mechanism of his astronomical clock to function and for metal parts not to rust by using hydraulics (water) or to freeze in winter.

Technology: One of the *Four Great Books of Song*, the Tàipíng guāngjì is a Chinese encyclopedia documenting various stories of Chinese myths and subjects of theology. Divided into 500 volumes, it consists of over 3-million written Chinese characters.

Near (11 years)

Transition Period (994-999)

Spain: The Muslim de facto ruler of al-Andalus, al-Mansur, with the support of the Christians Portuguese knights, sacks one of Christendom's holiest sites of pilgrimage, Santiago de Compostella. On their way they sack the cities of Zamora and Leon.

Technology: Hamid Ibn al-Khidr al-Khujandi (Arab astronomer) constructs giant sextant (17 meters).

Far (17 years)

Transition Period (1017-1022)

India: Largest amphibious invasion force in history happens when the Chola army that invades Lanka (Sri Lanka) with a massive manpower of 150,000 troops.

The huge *Kandariya Mahadeva* Hindu Temple is completed in the Chandela capital of Khajuraho.

Near (11 years)

Transition Period (1034-1039)

Far (17 years)

Transition Period (1057-1062)

Middle East: The Muslims expel 300 Christians from Jerusalem, and European Christians are forbidden to enter the Church of the Holy Sepulcher.

Near (11 years)

Transition Period (1074-1079)

Muslims: Suleyman I of Rûm becomes the leader of the Seljuk Sultanate of Rûm in modern Turkey. The Seljuk Turks capture Nicæa and Jerusalem.

al-Khayyami establishes himself as curator of the observatory at Isfahan. Although his excellent tables have been lost and his plans for calendar reform never realized, his calendar would have been off by less than one day every 5,000 years.

China: Chancellor Wang Anshi of Song Dynasty China creates a new bureau of the central government called the Directorate of Weapons, which supervises the manufacture of military armaments and ensures quality control. The iron industry in Song Dynasty China is producing a total weight of 127,000 tonnes of iron product per year.

Far (17 years)

Transition Period (1097-1102)

Europe: In 1095 Pope Urban II calls for a Crusade to retake the Holy Land. Other Crusades will be called in the following decades. Each will prove less successful than the first, which meets with marginal success, due to the sheer novelty of the crusaders' advent in the eastern Mediterranean. The crusaders bear clumsy broad swords, the sight of which would have driven a veteran Roman centurion to fits of laughter. Arab opponents can't rightly be called disciplined troops, but they carry decent swords at least.

Middle East: A large band of Crusaders approaches Speyer and massacres the Jewish population. The Norman crusaders join the rest of the army during the siege of Nicæa.

The city of Nicæa falls to the Crusaders after a month siege. Crusaders win the Battle of Dorylaeum and capture Latakia from the Seljuk Turks. At the battle of Harenc, the crusaders defeat the troops from Aleppo trying to come to the relief of besieged Antioch (Antakya). After eight months, the crusaders take Antioch.

15,000 starving Christian soldiers march around Jerusalem. Christian soldiers under Godfrey of Bouillon, Robert II of Flanders, Raymond IV of Toulouse and Tancred take Jerusalem after a difficult siege.

Technology: Rockets and fire-lances are used in China.

Near (11 years)

Chinese naval vessels use lodestone magnetic compasses for navigation.

Transition Period (1114-1119)

Europe: Pope Pelagius II grants the status of Crusade to the Christian effort in the Ebro valley, which attracts numerous Gascon, Occitan and Norman knights. Alfonso the Battler expels the Moors from Zaragoza. The troops of Ramon Berenguer III, Count of Barcelona led by archbishop Oleguer Bonestruga capture Tarragona from the Moors.

China introduces the modern book where separate pages are stitched together.

Far (17 years)

Transition Period (1137-1142)

Europe: Battle of Ourique: The independence of Portugal from the Kingdom of León is declared after Prince Afonso Henriques defeats the Almoravids led by Ali ibn Yusuf.

Peter Abelard writes the *Historia Calamitatum*, detailing his relationship with Héloïse. A church court in Sens, France condemns Pierre Abelard for heresy.

Africa: Abd al-Mu'min declares jihad on the Almoravids, charging them with decadence and corruption. He unites the northern Berbers against the Almoravids, overthrowing them and forming the Almohad Empire. During this period, northwestern Africa becomes thoroughly Islamized. It sees the spread of literacy, the development of algebra and the use of the number zero and decimals.

Near (11 years)

Transition Period (1154-1159)

Constantinople, capital of the Byzantine Empire becomes the largest city of the world, taking the lead from Merv in the Seljuk Empire.

Far (17 years)

Transition Period (1177-1182)

Muslims: A fleet led by Abd Allah Ishaq Jami attacks Lisbon, but is repelled by the Portuguese admiral D. Fuas Roupinho near the Cape Espichel. The Portuguese admiral later manages to enter in the harbor of Ceuta and destroy a number of Muslim ships. It is the beginning of a four-year naval conflict between Almohads and Portuguese. After a series of defeats, the Almohad navy under the admiral Ahmad al-Siqilli crushes the Portuguese fleet and reasserts its control over the Atlantic Ocean.

China: Hangzhou, capital of Southern Song China, becomes the largest city of the world, taking the lead from Fes in the Almohad Empire.

Science: Chinese and Japanese astronomers observe what has since come to be understood as a supernova. One of only eight supernovae in the Milky Way observed in recorded history, it appears in the constellation Cassiopeia and is visible in the night sky for about 185 days. The radio source 3C58 is thought to be the remnant from this event.

Near (11 years)

Transition Period (1194-1199)

Middle East: Bohemond I, the new crusader ruler of Antioch (Antakya) grants commercial privileges and the right to use warehouses (fondaco) and the church of Saint John to the Republic of Genoa. This marks the beginning of

Italian merchant settlements in the Levant.

Mongols: Genghis Khan has survived incredible hardships as a teenager and young adult. He establishes his leadership for a small but feisty horde within the borders of Mongolia.

Mesoamerica: The Aztec civilization begins in Mexico.

Far (17 years)

Transition Period (1217-1222)

Mongols: Fresh from pillaging northern China, Genghis Khan leads his horse-archers west where they devastate Kyrgyz and make inroads to northern India.

Mongols under the leadership of his eldest son Jochi conduct a 2nd-campaign against the Kyrgyz. The Mongols first invade the Abbasid Caliphate where Bukhara and Samarkand (Uzbekistan) are taken. The Mongol Army under Jochi captures the city of Gurganj (now Kunya-Urgench), and massacres the inhabitants. Contemporary scholars report over a million killed, although probably only a fifth or a tenth of that number in reality.

The windmill is first introduced to China with the travels of Yelü Chucai to Transoxiana.

Near (11 years)

Transition Period (1234-1239)

Mongols: Song Dynasty Chinese and Mongolian armies occupy the Jurchen capital at Caizhou, marking the collapse of the Jin Dynasty (1115–1234). Four of 58 districts in Sichuan, China, are captured from the Southern Song by the Mongols under Ögedei. The population of Chengdu, roughly one million inhabitants, is summarily slaughtered after the Mongols take the city with little effort.

After 15 years of campaigns the Caucasus, Asia Minor and Persia, Batu Khan leads representatives of all four khanates of 150,000 Mongol, Turkish and

Persian troops into Europe with the resumption of the Mongol invasion of Russia. Battle of the Sit River: The Mongol Hordes of Batu Khan defeat the Russia under Yuri Vsevolodovich of Vladimir-Suzdal.

Far (17 years)

Roger Bacon (Oxford, England) builds a practical magnifying glass.

Transition Period (1257-1262)

Mongols: General Baiju (operating under Hulagu Khan's command) leads his forces in a victory over Kay Ka'us II of the Sultanate of Rüm, thereby capturing Anatolia (west-central Turkey). Hulagu Khan captures and destroys the Hashshashin stronghold at Alamut in present-day Iran and overruns Baghdad, a leading center of Islamic culture and learning and capital of the Abbasid Caliphate. Mongols burn the imperial city to the ground, killing as many as 1,000,000 citizens. Hugalu Khan establishes the Ilkhanate dynasty of Persia, which will become one of four main divisions of the Mongol Empire.

The Mamluks defeat the Mongols at the Battle of Ain Jalut in Galilee, marking their first decisive defeat and maximum expansion of the Mongol Empire.

Kublai Khan begins a twofold attack on the Song dynasty of southern China. On one hand, he sends armies to subdue the western provinces of the Song. More important, he begins wholesale reforms in the areas of China he controls. He reduces taxes, improves roads, minimizes torture of suspected criminals, codifies laws that apply to people of all ranks, decrees religious freedom for all, establishes thousands of public schools where subjects are taught in the colloquial languages of the neighborhoods. While such measures embody an ingenious PR campaign to promote his administration style over that of the Song dynasty, the measures foreshadow democratic initiatives that won't take root in Europe from many centuries to come.

While engaged in a war with the Mongols, the Song Chinese official Li Zengbo records the city of Qingzhou is making one to two thousand strong iron-cased gunpowder bombshells a month, dispatching to Xiangyang and Yingzhou in

batches of 15,000 bombs.

Technology: The earliest extant Chinese illustration of ‘Pascal’s triangle’ is from Yang Hui’s book *Xiangjie Jiuzhang Suanfa*, published in this year, although knowledge of Pascal’s Triangle existed in China as early as 1100.

Natural Events: One of the largest volcanic eruptions of the Holocene epoch occurs, possibly from a tropical location such as Mount Rinjani, Indonesia; El Chichón, Mexico; or Quilotoa, Ecuador. Observed effects of the eruption include the following anecdotal accounts: dry fog in France; lunar eclipses in England; severe winter in Europe; a “harsh” spring in Northern Iceland; famine in England, Western Germany, France, and Northern Italy; and pestilence in London, parts of France, Austria, Iraq, Syria and Southeast Turkey.

Near (11 years)

Transition Period (1274-1279)

Byzantium: The Constantinople suburb of Beyoğlu (then known as Pera) is given to the Republic of Genoa by the Byzantine Emperor Michael VIII Palaeologus in return for Genoa’s support of the Empire after the 4th-Crusade and the sacking of Constantinople.

Mongols: The 200,000 multiethnic troops of the Mongol-led Yuan Dynasty, headed by the Turkish commander Bayan, face a Chinese Song Dynasty army of 130,000 led by the Song Chancellor Jia Sidao. The result is a decisive victory for the Yuan Dynasty, and soon after the much-vilified Jia Sidao is stripped of rank and title, and killed by one of his own guards after the Song court exiles him to Fujian. The court of the Southern Song Dynasty of China and hundreds of thousands of its citizens flee from Hangzhou to Fujian and then Guangdong to escape an invasion by Kublai Khan’s Yuan Dynasty.

Kublai Khan attempts the first of several invasions of Japan. 30,000 soldiers and support personnel sail from Korea. After the Mongols capture outlying islands, they are repulsed on the main island at the Battle of Bun’ei by amassed Japanese warriors and a strong storm which batters their forces and fleet.

Battle of Ngasaunggyan: Burma's Pagan Empire begins to disintegrate after being defeated by Kublai Khan at Yunnan near the Chinese border. Battle of Elbistan, Turkey: Mamluk sultan Baibars invades the Seljuk Sultanate of Rûm and defeats a Mongol army.

Technology: Chinese astronomers observe a total eclipse of the Sun in China. Giles of Lessines writes his *De usuris*. He estimates that accrued-credit contracts need not to be usurious as “future things are not estimated to be of such value as those collected in the instant.” The prevalence of this view in the usury debate allows for the development of the financial industry in Catholic Europe.

Far (17 years)

Transition Period (1297-1302)

Africa: Empire of Mali (Sub-Saharan Africa) reaches its peak. Queen Amina of Zazzau expands the Zaria emirate through a series of wars.

Europe: Charles, Count of Valois, enters Florence with the Black Guelphs who destroy much of the city, kill many of their enemies and install a new government under Cante de' Gabrielli da Gubbio as *podestà*, leading to Dante's permanent exile from the city.

Technology: The Chinese governmental minister Wang Zhen (official) invents wooden movable type for printing. Bi Sheng invented ceramic movable type in the 11th-century.

Near (11 years)

Transition Period (1314-1319)

China: Wang Zhen, Chinese agronomist, government official, and inventor of wooden-based movable type, publishes the *Nong Shu* (Book of Agriculture).

Far (17 years)

Transition Period (1337-1342)

Europe: The 100 Years War between France and England begins. The Battle of Sluys is fought between the naval fleets of the Kingdom of England and the Kingdom of France. The former is under the command of Edward III of England and the latter under that of Admiral Hugues Quiéret and treasurer Nicholas Béhuchet assisted by Genoese mercenary galleys under Egidio Bocanegra. The French fleet is virtually destroyed and both commanders are killed.

Muslims: Nicomedia is captured by the Ottoman Empire.

Near (11 years)

Bubonic plague devastates Europe. More than one-third of the population is killed between 1347-51.

Transition Period (1354-1359)

Muslims: The Turks capture the cities of Kallipolis and Didymoteicho from the Byzantine Empire.

Bahri Sultan An-Nasir removes the limestone casing stones from the Great Pyramid of Giza. He uses them to build fortresses and mosques in the nearby city of Cairo, leaving the first of the Seven Wonders of the Ancient World in the step-stone condition in which it remains today.

China: Nanjing in Mongolian China becomes the largest city of the world, taking the lead from Hangzhou in Mongolian China.

Far (17 years)

Transition Period (1377-1382)

Muslims: The Venetians and Ottomans invade Constantinople and restore John V Palaiologos as Byzantine co-emperor. Andronikos IV Palaiologos is allowed to remain as Byzantine co-emperor but is confined to the city of Silivri for the remainder of his life.

China: In Ming Dynasty China, the *lijia* census registration system that began

in 1371 is now universally imposed during the reign of the Hongwu Emperor. The census counts 59,873,305 people living in China in this year. This depicts a drastic drop in population since the Song Dynasty, which counted 100 million people at its height in the early 12th-century. The historian Timothy Brook, in his *The Confusions of Pleasure: Commerce and Culture in Ming China*, states that the Ming census was inaccurate, as China in the late 14th-century had at least 65,000,000 inhabitants, if not 75,000,000.

Near (11 years)

Transition Period (1393-1398)

Muslims: The Ottoman Turks capture Turnovgrad (now Veliko Tarnovo), the capital city of east Bulgaria. Emperor Ivan Shishman is allowed to remain as puppet ruler of east Bulgaria. The Ottomans begin an eight-year siege of Constantinople.

Europe: Battle of Rovine: With the help of the Hungarians, Wallachia resists an invasion by the Ottomans and their Serb and Bulgarian vassals.

Africa: Most of Great Zimbabwe stone buildings are completed.

Technology: Ming Dynasty Chinese records 720,000 sheets of toilet paper (.61 by .91 meters) being produced for the various members of the imperial court at Beijing. The Imperial Bureau of Supplies orders 15,000 sheets of toilet paper made of soft-yellow tissue and perfumed.

Far (17 years)

Transition Period (1416-1421)

Europe: The battle of Agincourt happens on the cusp of this period, in the late autumn of 1415. The smaller army of English peasants use the longbow to defeat a swarm of French knights in heavy armor. This victory shows that it's possible to defeat armored cavalry (and infantry) with a powerful new weapon. It also shows (once again) that commoners could fight as bravely as landed

gentry. Henry V used this victory and subsequent clashes to bring Normandy under English rule. The French recognize him in the Treaty of Troyes (1420) as the regent and heir to the French throne. His marriage to Catherine of Valois, the daughter of King Charles VI, cements his ascension to power.

The Republic of Ragusa is the first state in Europe to outlaw slavery.

Portuguese sea captains João Gonçalves Zarco and Tristão Vaz Teixeira, at the service of Prince Henry the Navigator, discover the Madeira Islands.

Near (11 years)

Transition Period (1433-1438)

The **Ming Dynasty** in China disbands its naval fleet after the last great maritime expedition led by Admiral Zheng He, altering the balance of power in the Indian Ocean and making it easier for Portugal and other Western naval powers to gain dominance over the seas.

A significant portion of the southern grain tax is commuted to payments in silver, known as the Gold Floral Silver (jinhuiyin). This comes about because the clerical and military arms of government demand payment in silver instead of grain. Some counties have trouble transporting all the required grain to meet their tax quotas, so it makes sense to pay the government in silver, a medium of exchange that is already abundant amongst landowners through their own private commercial affairs. As a result, more silver is drawn into nationwide circulation.

Just two years after the court of China allowed landowners to pay their grain tax in silver instead, the Ming court decides to close all silver mines and to ban all private silver mining in Zhejiang and Fujian provinces. This is a concerted effort to halt the increase of silver circulating into the market. Illegal mining of silver becomes an offense punishable by death. The high demand for illegal mining also makes it very lucrative, so many choose to defy the government and continue to mine silver.

The **Florentine** polymath Leon Battista Alberti begins writing the treatise *On*

Painting, in which he argues for the importance of mathematical perspective in the creation of three-dimensional vision on a two-dimensional plane. This follows the ideas of Massacio and his concepts of linear perspective and vanishing point in artwork.

Far (17 years)

Muslims: For decades the Ottoman Turks have ravaged Byzantine holdings in the Peloponnese, Asia Minor and the Balkans. At long last, the Sultan Mehmet II captures Constantinople after brief siege and sea blockade. This marks the final dying gasp of the Roman Empire.

Europe: The first black African slaves are brought to Europe at Lagos, Portugal.

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Classical History (504 BC - 495 AD)

I have focused on the rise and fall of Greco-Roman culture, selecting (I hope) those events that influence the most significant changes. The decline of the Roman Empire might be especially instructive for modern readers. The Roman Empire was primarily secular and generally tolerant of the many religious faiths held by its subjects. In this way, Rome simulates the hodgepodge of cultures that embody the world today.

Romans embraced practical applications of technology, whereas the Greeks contented themselves with theoretical speculations. Romans built fine-arched buildings, aqueducts, straight-arrow roads. Their waterworks and sewage systems could stand proudly with much of the current urban infrastructure. Romans built wonderful public baths throughout the Empire. The cost of bathing, even for the poor, was relatively cheap. This custom of almost universal cleanliness raised the status of women who often refused intimacy with their partners until they washed the stink of the road from their bodies.

The downside, of course, was the lead lining of the plumbing. Romans didn't understand that lead absorption weakened bones and brought on premature rheumatism and arthritis. This too shows a similarity with today's culture, since we moderns have introduced thousands of industrial molecules and organic compounds for which there is little known about side effects over the long run.

Roman swords were sized correctly for close-quarter engagements and had razor-sharp edges. Legionaries had three kinds of spears for

use in different military situations. A legion's artillery pieces (crossbows and rock hurlers) were designed to cause havoc among enemy formations.

Nowadays folks look with distaste at societies that condoned slavery, but slavery in ancient times was commonplace. It solved the problem of what do with the vanquished in the aftermath of war. The victors couldn't allow captured enemy soldiers off Scott-free unless they were prepared to fight them again. Whereas the salvage of valuables from vanquished cities helped pay for the costs of military campaigns, the sales of soldiers and civilians into slavery turned costly campaigns into profitable ventures.

The fates of enslaved soldiers were harsh, since they were inducted into the legions or condemned to hard physical labor in underground mines or rock quarries. But civilian slaves faced brighter futures, since they performed the tasks of domestic servants or concubines. Occasionally they became wives or consorts. On the deaths of their owners, slaves often gained free-person status in the dominant culture. Many Greek scholars volunteered to become slaves for Roman masters. They toiled as child tutors, consultants or soothsayers, gaining respect for their philosophical or medical know-how. Their careers advanced further than they would have as "free" men back home. If you ignore the minority of slave owners who were abusive and sadistic and the relative cultural norms, the livelihoods of slaves in antiquity were not much different than the livelihoods of wage earners today.

The Roman ethos makes a good parallel for our current global culture. In its declining years, the Empire came under threat from outland barbarians because its vigilance and institutions wallowed in

decadence. Nowadays the world community is under threat from terrorist dissidents and the implications of climate change. Our institutions do not seem capable of dealing with these threats.

Circa 6th-century BC: There are thriving urban cultures in China, the Indian subcontinent, Mesopotamia, the Nile Valley and sub-Saharan Africa. Persians dominate the Middle East. Greek and Phoenician ships pursue trade in the Mediterranean. Greeks have a lock on commerce around the Aegean Sea. Their trading outposts defy the edicts of Persian Kings.

Transition Period (503-498 BC)

Persian Empire attacks Aegean city of Naxos. Aristagoras, governor of Miletus, induces the Ionian cities of Asia Minor to revolt against Persia, thus instigating the Ionian Revolt and beginning the Greco-Persian Wars between Greece and Persia.

China: Confucius is appointed governor of Chung-tu.

Near (11 Years)

Transition Period (486-481 BC)

Middle East: Here marks the lull between Persian invasions. The Greeks have been heartened by the victory of Marathon in 490 BC. They are bracing themselves for another invasion. The Persians are busy assembling a grand army and naval taskforce.

Indian Subcontinent: Death of Gautama Buddha is recorded in 483 BC.

Far (17 Years)

Greece: Athenians move their citizens to an island and thumb their noses at the Persian land force, which outnumbers them many times over. They defeat the Persian navy in 480 BC. Disheartened, the king will return to Persia. A

combined Athenian and Spartan army will drub the Persian land force. These victories will set the stage for the Golden Age.

Greek city-states enjoy prosperity and population growth. Greek culture flourishes among the cities of the Aegean Sea. Greek influence will spread as far as Cyprus, Crete, Sicily and Massilia (Marseilles) on the southern coast of France. The plays of Aeschylus are performed. Greeks absorb Egyptian geometric insights. Thought experiments are born.

Transition Period (463-458 BC)

Greece: Relations are strained between Athens and Sparta, but Kimon of Athens counsels reconciliation. When faced with a slave revolt in 465 BC, Sparta asks for Athenian assistance. Kimon leads an Athenian army to the rescue, but somehow he manages to irk the Spartans who proceed alone. Athenians take this as a grave insult, and they launch the 1st-Peloponnesian War in 460 BC. The hostilities will prove inconclusive. But after a brief truce, Spartan and Athens will commence a long and bloody series of wars, which will drain the military might of Greece for centuries to come.

Near (11 Years)

Transition Period (446-441 BC)

Greece: A revolt breaks out in Boeotia as the oligarchs of Thebes conspire against the democratic faction in the city. The Athenians under their general Tolmides bring 1,000 hoplites plus other troops from their allies. They march into Boeotia to take back the towns revolting against Athenian control. They capture Chaeronea, but are attacked and defeated by the Boeotians at Coronea. As a result, the Athenians are forced to give up control of Boeotia as well as Phocis and Locris, which all fall under the control of hostile oligarchs who quit the Delian League.

Pericles is concerned over the draining effect of years of war on Athenian manpower. He looks for peace with the support of the Assembly. Athenian

diplomat, Callias, goes to Sparta and after much bargaining arranges a peace treaty with Sparta and her Peloponnesian allies, thus extending the five-year truce for another 30 years.

Pericles commissions the architects Kallikrates and Iktinos to design a larger temple for the Parthenon and the construction begins on rebuilding the great temple of Athena (the Parthenon) on the Acropolis at Athens soon afterwards. Sophocles writes Antigone.

Rome: In the Battle of Corbione, Titus Quinctius Capitolinus Barbatus leads Roman troops to a victory over the Aequi of northeast Latium and the Volsci of southern Latium.

Far (17 Years)

The pulley is invented and the first true arch is constructed.

Transition Period (423-418 BC)

Peloponnesian War: Demosthenes captures and fortifies the port of Pylos in the Peloponnesus, giving Athens a strong base close to Sparta. Meanwhile, a Spartan army, commanded by Brasidas, lands on the nearby island of Sphacteria (Sfaktiria), but is repulsed by the Athenians. An Athenian fleet summoned by Demosthenes bottles up the Spartan navy in Navarino Bay.

Cleon joins Demosthenes in the invasion by Athenian troops of Sphacteria. The resulting Battle of Pylos results in an Athenian victory leading to the surrender of many of the Spartan troops. Pylos remains in Athenian hands, and is used as a base for raids into Spartan territory and as a refuge for fleeing Spartan helots.

Following the failure of peace negotiations between Athens and Sparta, a number of Spartans stranded on the island of Sphacteria (Sfaktiria) after the Battle of Pylos are attacked by an Athenian force under Cleon and Demosthenes. The resulting Battle of Sphacteria leads to a further victory by the Athenians over the Spartans. The Spartans sue for peace, but the Athenian leader Cleon persuades Athens to refuse.

Near (11 Years)

Transition Period (406-401 BC)

Peloponnesian War: The Spartan admiral Lysander refuses to be lured out of Ephesus to do battle with Alcibiades. However, while Alcibiades is away seeking supplies, the Athenian squadron is placed under the command of Antiochus, his helmsman, and the Spartan fleet attacks and wins the Battle of Notium (or Ephesus). The defeat gives the enemies of Alcibiades an excuse to strip him of his command. He never returns to Athens.

To relieve Conon, the Athenians assemble a new fleet composed largely of newly constructed ships manned by inexperienced crews. This inexperienced fleet is inferior to the Spartans, but its commanders employ new and unorthodox tactics, which allow the Athenians to secure a dramatic and unexpected victory at the Battle of Arginusae, and the blockade of Conon is broken.

The Spartan king Pausanias lays siege to Athens while Lysander's fleet blockades Piraeus. This action closes the grain route through the Hellespont, thereby starving Athens. Theramenes tries to negotiate with Lysander. He is away for three months while Athens is being reduced to starvation. Then he heads the embassy that negotiates the terms of capitulation to the Spartans.

Theramenes secures terms that save the city of Athens from destruction. The Spartans allow Athens to retain its independence. However, Athens loses all its foreign possessions and what is left of its fleet and is required to become an ally of Sparta. The Long Walls around Athens are pulled down. Greek towns across the Aegean Sea in Ionia are again the subjects of the Persian Empire.

Thrasybulus leads the democratic resistance to the new oligarchic government, known as the Thirty Tyrants, that the victorious Spartans have imposed on Athens. He commands a small force of exiles that invades Attica and defeats first a Spartan garrison and then the forces of the oligarchic government (including the Spartan general, Lysander) in the Battle of Munychia. The leader of the Thirty Tyrants, Critias, is killed in the battle.

The Battle of Piraeus is fought between Athenian exiles, who have defeated

the government of the Thirty Tyrants and occupied Piraeus, and a Spartan force sent to combat them. In the battle, the Spartans narrowly defeat the exiles, with both sides suffering large numbers of casualties. After the battle, the Agiad King of Sparta, Pausanias arranges a settlement between the two parties which allows the reunification of Athens and Piraeus, and the re-establishment of democratic government in Athens.

Sicilian War: The Carthaginians again invade Sicily and attack Agrigentum (Agrigento). Plague breaks out in their camp and Hannibal Mago dies. Himilco assumes command and captures Agrigentum, Gela and Camarina. Gela is destroyed and its treasures sacked. The survivors take refuge in Syracuse. The plague is carried back to Carthage by its soldiers.

Dionysius the Elder rises to power as the tyrant of Syracuse. He makes peace with the Carthaginian general, Himilco (whose army has been weakened by the plague), and fortifies Syracuse. This treaty leaves Carthage in control of most of Sicily. Dionysius the Elder ruthlessly consolidates and expands his power. He builds a wall around Syracuse and fortifies Epipolae. The Greek citizens of Naxos, Catana and Leontini are removed from their cities; many of them are enslaved and their homes are given to Sicilian and Italian mercenaries.

Marquis Wen of Wei ascends to power in Wei. He sponsors Confucianism and employs able political advisers such as Li Kui, Wu Qi and Ximen Bao.

Far (17 Years)

Transition Period (383-378 BC)

Greece: King Amyntas III of Macedon, forms a temporary alliance with the Chalcidian League. Sparta, whose policy is to keep Greeks disunited, sends an expedition northwards to disrupt the Chalcidian League, a confederation of cities of the Chalcidice (Khalkidhiri) peninsula, east of Macedonia.

The Spartan commander Phoebidas, who is passing through Boeotia on campaign, takes advantage of civil strife within Thebes to gain entrance to the city for his troops. Once inside, he seizes the Cadmeia (the citadel of Thebes),

and forces the anti-Spartan party to flee the city. The government of Thebes is placed in the hands of the pro-Spartan party, backed by a Spartan garrison based in the Cadmeia. Many of the previous leaders of Thebes are driven into exile.

In punishment for his unauthorized action in the previous year of taking over Thebes, Phoebidas is relieved of his command, but the Spartans continue to hold Thebes.

A small group of Theban exiles, led by Pelopidas, infiltrate the city of Thebes and assassinate the leaders of the pro-Spartan government. Epaminondas and Gorgidas lead a group of young men who break into the city's armories, take weapons, and surround the Spartans on the Cadmea, assisted by a force of Athenian hoplites. In the Theban assembly the next day, Epaminondas and Gorgidas bring Pelopidas and his men before the audience and exhort the Thebans to fight for their freedom. The assembly responds by acclaiming Pelopidas and his men as liberators. Fearing for their lives, the Spartans surrender and are evacuated. The Thebans of the pro-Spartan party are also allowed to surrender; they are subsequently executed.

Rome: After a revolt against Rome, the district of Tusculum (Frseati) is pacified and conquered. The people of Tusculum express complete submission to Rome, so they become the first *municipium cum suffragio*, and thenceforth the city continues to hold the rank of a municipium.

Catapults are used as siege weapons.

Near (11 Years)

Transition Period (366-361 BC)

Greece: Theban leader Pelopidas goes on an embassy to the Persian king Artaxerxes II and induces him to propose a settlement of the Greek states' disputes according to the wishes of the Thebans. Artaxerxes II issues an edict consisting of peace terms for the Greeks, but his edict is not obeyed by any of the Greek states.

The Theban general, Epaminondas, makes a bold attempt to challenge Athens'

naval empire. With a new Boeotian fleet, he sails to Byzantium, which results in a number of cities in the Athenian Empire rebelling against their now threatened masters.

The outbreak of civil war in the Arcadian league leads to Mantinea fighting alongside Sparta and Athens, while Tegea and others members of the league side with Thebes. The Theban general, Epaminondas, heads the large allied army in the Peloponnesus. He is met by Sparta (led by Spartan general Archidamus III), Athens and their allies in the Battle of Mantinea. In the battle, Epaminondas is victorious, but is killed. His dying command to make peace with the enemy is followed by all sides and a general peace is established in Greece. The period of Theban domination of Greece comes to an end.

China: The Chinese astronomer Gan De from the State of Qi reportedly discovers the moon Ganymede, belonging to Jupiter, and makes the earliest known sunspot observations.

Far (17 Years)

Transition Period (343-338 BC)

Sicily: Syracuse grows sick of tyrant Dionysius II and appeals to its mother city of Corinth. The Corinthian general Timoleon is chosen to lead a liberation force to Sicily. Landing at Tauromenium (Taormina) in the summer, Timoleon faces two armies, one under Dionysius and the other under Hicetas (tyrant of nearby Leontini), who has also called in Carthaginian forces. By shrewd tactics Timoleon defeats his enemies and occupies Syracuse.

Persia: Artaxerxes III, the King of Persia, heads an invasion of Egypt. The Persians are keen to seize Egypt's gold and corn supplies. The town of Pelusium in the Nile Delta puts up resistance, but Pharaoh Nectanebo II is forced to retreat to Memphis. As the situation deteriorates, Nectanebo II leaves for exile in Nubia. His departure marks the end of the 30th Dynasty, the last native house to rule Egypt.

Greece: King Philip II of Macedon again marches against Cersobleptes, King

of Thrace, and defeats him in several battles, and reduces him to the condition of being a tributary.

Philip II invites the Greek philosopher Aristotle to his capital at Pella to tutor his son Alexander. As the leading intellectual figure in Greece, Aristotle uses his intellectual acumen to prepare Alexander for adult leadership.

When King Philip II of Macedon attacks Perinthus and Byzantium, King Artaxerxes III of Persia sends support to those cities. Philip II fails in his siege of Byzantium and is forced to respond to attacks by the Scythians near the mouth of the Danube. His son, Alexander is regent while his father fights against Byzantium and the Scythians.

Philip II attacks the Scythians, using as an excuse their reluctance to allow Philip to dedicate a statue of Heracles at the Danube estuary. The two armies clash on the plains of modern-day Dobruja. Ateas, the 90-year-old King of the Scythians, is killed during the battle and his army is routed.

Rome: The Battle of Mount Gaurus is fought between the Romans and the Samnites. The battle is a success for the Romans, who are led by Marcus Valerius Corvus. Fought at the foot of Mount Gaurus, near Cumae, it is the most notable engagement of the First Samnite War. The Roman-Samnite army under consuls Decius Mus and Titus Manlius Torquatus attack and defeat the Latins and Campanians near Mount Vesuvius in the Battle of Vesuvius.

The Romans succeed in detaching the Campanians from their alliance with the Latins (through their fear of the Samnites) and induce them to make a separate peace. Three Campanian cities, including Capua and Cumae, are granted Roman citizenship. This results in the major acquisition by Rome of the rich land of Campania with its capital of Capua, and the Roman state now extends to the Bay of Naples.

In China during the Warring States Period, the army of the state of Qi defeats the army of the state of Wei in the Battle of Maling. This battle involves the military strategy of the general Sun Bin (descendant of Sun Tzu), and is the 1st-battle in recorded history to give a reliable account of the handheld crossbow with a trigger mechanism.

Near (11 Years)

Alexander The Great conquers the known world.

Transition Period (326 -321 BC)

Egypt: In 323 BC, the first Ptolemy retrieves the body of Alexander and places it in a crystal tomb, which gives his stronghold a popular tourist attraction. Ever after, Alexandria flourishes as one of the most populous and sophisticated urban centers of antiquity. Though founded eight years earlier, the city is unique because it is laid out from scratch. The urban design incorporates a rectangular grid of roadways surrounding rectangular blocks, where the streets are oriented either north-south or east-west. Urban planners will emulate this grid design with great success until the 20th-century. The advent of the automobile makes four-way intersections cumbersome and unwieldy. Stop & go semaphores have reduced accidental collisions at the expense of reducing traffic flow. This problem remains unsolved well into the 21st-century.

Far (17 Years)

Transition Period (303-298 BC)

Greece: Antigonus I Monophthalmus sends his son Demetrius to conquer Rhodes, which has refused him armed support against Ptolemy. Demetrius shows ingenuity in devising new siege engines in his unsuccessful attempt to reduce the city. Among his creations are a battering ram 60 meters long and requiring 1,000 men to operate it and a wheeled siege tower named Helepolis or Taker of Cities, which stands 40 meters tall and 20 meters wide and weighs 180 tons. This siege of Rhodes earns Demetrius the title *Poliorcetes* (City Besieger).

Mesoamerica: Mexican Sun Temple Artetello is built at Teotihuacán.

Near (11 Years)

Transition Period (286-281 BC)

Rome: A new law, Lex Hortensia, gives much greater power to the plebeian Assembly compared to the Senate. This law is passed following a threat from plebeian soldiers to secede. In the face of this threat, the Senate yields to plebeian demands for more political power and for recognition of their labors. The law is named after Quintus Hortensius, a plebeian, who is made dictator to settle the controversy.

In theory the Lex Hortensia is supposed to dissolve the political distinctions between the patricians and the plebeians. In practice the coalition of leading plebeian families keeps control and largely nullifies the power of the assemblies. So Roman government continues to be oligarchic in character.

The Gallic tribe called the Senones, who has settled on the Adriatic coast north of Picenum, attacks Arretium in Etruria. While attempting to relieve this allied city, the Romans under the command of Lucius Caecilius Metellus Denter suffer a costly defeat in the Battle of Arretium. Aroused by this disaster, a Roman army under Manius Curius Dentatus invades the Senones' territory, defeating them and driving them out of the Italian peninsula.

At the Battle of Lake Vadimo, Roman forces finally quell the allied Etruscans and Gauls. Consul Publius Cornelius Dolabella leads the Roman army. Rome is at last undisputed master of northern and central Italy.

Egypt: A 110-meter tall lighthouse on the island of Pharos in Alexandria's harbor is completed and serves as a landmark for ships in the eastern Mediterranean. Built by Sostratus of Cnidus for Ptolemy II of Egypt, it is one of the seven wonders of the ancient world. It is a technological triumph and is the archetype of all lighthouses since. A broad spiral ramp leads to the top, where a fire burns at night.

Ptolemy II enlarges the library at Alexandria and appoints the grammarian Zenodotus to collect and edit all the Greek poets. The canal from the Nile River to the Red Sea, initially started but not completed by the Egyptian pharaoh Necho II and repaired by the Persian king Darius I, is again repaired and made operational.

Far (17 Years)

The famous statue (Colossus at Rhodes) is built.

Transition Period (263-258 BC)

1st-Punic War: The naval battle of the Lipari Islands (Lipara harbor) in 260 BC marks the 1st-encounter between the fleets of Carthage and the Roman Republic. The resounding Carthaginian victory results from an ambush more than a fixed battle. The defeat sends Romans a wake-up call.

Within two months the Romans build a fleet of over 100 warships. Because they know that they can't defeat the Carthaginians with traditional tactics of ramming and sinking enemy ships, the Romans add the *corvus*, an assault bridge, to Roman ships. The hinged bridge swings toward enemy vessels with a sharp spike and stops them. Roman legionaries can then board and capture Carthaginian ships. This innovative Roman tactic checks the Carthaginian naval advantage in ship-to-ship engagements, and allows Rome's superior infantry to be used in naval conflicts.

Egyptian Technology: Archimedes constructs a mechanical device to lift water uphill. Afterwards it is known as the Archimedean screw.

Near (11 Years)

Transition Period 246 BC - 241 BC)

Egypt: Ptolemy III wins major victories over Seleucus II in Syria and Anatolia and briefly occupies Antioch (Antakya). These victories are marred by the loss of the Cyclades to Antigonus II Gonatas in the Battle of Andros. Babylon and Susa fall to the Egyptian armies of Ptolemy III.

The war in Asia Minor and the Aegean Sea intensifies as the Achaean League allies itself to Ptolemy III of Egypt, while Seleucus II secures two allies in the Black Sea region. Ptolemy III's armies reach as far as Bactria and the borders of India in their attacks on the Seleucid Empire.

When Ptolemy III returns from Syria to put down a revolt in Egypt, Seleucus II is able to regain control of Mesopotamia and parts of Northern Syria. Ptolemy III carries home large amounts of treasure and works of art, including many statues of Egyptian gods carried off to Persia by Cambyses.

The destruction of the Egyptian fleet by the Macedonians ends the naval supremacy of the Ptolemies but does not force them to relinquish their territories in Syria and the Aegean Sea.

Greece: Drawing upon the tradition of the Spartan lawgiver Lycurgus, the young Eurypontid king of Sparta, Agis IV, seeks to reform a system that distributes the land and wealth unequally and burden the poor with debt. He proposes the cancellation of debts and the division of the Spartan homeland into separate lots for each of its citizens. Full citizenship is to be extended to many *perioeci* (voteless freemen) and foreigners. In addition to pursuing these reforms, Agis seeks the restoration of the Lycurgan system of military training. Agis is supported by his wealthy mother and grandmother (who surrender their property), by his uncle Agesilaus, and by Lysander, who is an ephor (magistrate with the duty of limiting the power of the king).

China: An irrigation canal about 160 kilometers long is built across the current-day province of Shaanxi in China, greatly adding to the agricultural productivity of the area and to the military potency of the Qin dynasty.

Far (17 Years)

Transition Period (223-218 BC)

Rome: The Romans, led by Consuls Gaius Atilius Regulus and Lucius Aemilius Papus, decisively defeat the coalition of Cisalpine Gallic tribes at the Battle of Telamon thus extending Roman influence over northern Italy. On the Roman side Gaius Atilius Regulus, commander of the Roman cavalry, is killed in the battle. On the Gallic side, one of the leaders, Concolitanus, is captured in battle, while the leader of the Gaesatae, Aneroëstes, kills himself when the battle is lost.

Mediolanum (modern Milan) is the stronghold of the Gallic tribe of the

Insubres (led by Viridomarus). Mediolanum falls to Roman legions in Lombardy (led by consul, Marcus Claudius Marcellus), in the Battle of Clastidium. Rome strikes again against the Illyrian pirates precipitating the Second Illyrian War.

Carthage: Following the assassination of Hasdrubal, Hannibal, the son of the Carthaginian general, Hamilcar Barca, is proclaimed commander-in-chief by the army and his appointment is confirmed by the Carthaginian government. Hannibal immediately moves to consolidate Carthage's control of Spain. He marries a Spanish princess, Imilce, then begins to conquer various Spanish tribes. He fights against the Olcades and captures their capital, Althaea; quells the Vaccae in the northwest; and, making the seaport of Cartagena (Carthago Nova, the capital of Carthaginian Spain) his base, wins a resounding victory over the Carpetani in the region of the Tagus River.

Hannibal lays siege to Saguntum thus initiating the 2nd-Punic War between Carthage and Rome. Saguntum is an independent Iberian Peninsula city south of the Ebro River. In the treaty between Rome and Carthage concluded in 226 BC, the Ebro has been set as the northern limit of Carthaginian influence in the Iberian Peninsula. Saguntum is south of the Ebro, but the Romans have *friendship* with the city and regard the Carthaginian attack on it as an act of war. They send envoys to Carthage and demand the surrender of Hannibal.

China: Qin Shi, the 1st-emperor, unifies China in 221 BC. He begins a system of tree-lined roads to interconnect all parts of China, and begins to join regional walls to form the beginnings of the Great Wall (Wan li chang cheng). His alchemists and engineers perform experiments with gunpowder.

Apollonius of Perga explores the geometric attributes of the ellipse and hyperbola.

Near (11 Years)

In Syracuse (Sicily) Archimedes designs heavy-lift cranes and catapults to defend the city against Roman naval assaults.

Transition Period (206-201 BC)

2nd-Punic War: After many embarrassing defeats at the hands of Hannibal, Romans adopt a more cautious approach suggested by Fabius Maximus. The adversity of 2nd-Punic War has strengthened Roman resolve and honed their military skills.

The Battle of the Metaurus, fought near the Metaurus River in Umbria, is a pivotal battle during the Second Punic War between Rome and Carthage. Hannibal's brother Hasdrubal Barca leads the Carthaginians, and the consuls Marcus Livius Salinator and Gaius Claudius Nero lead the Roman armies. The Romans defeat the Carthaginian army and Hasdrubal is killed in the battle. This major loss by the Carthaginians ends Hannibal's hopes of success in Italy.

Publius Cornelius Scipio ignores Hannibal's presence in Italy and flouts opposition from the Roman Senate. He decides to go after Carthaginian holdings in North Africa. He crosses to Sicily with an army consisting partly of volunteers, since the Roman Senate won't assign him an army. Scipio sends the Roman general Gaius Laelius to North Africa to prepare the way for his later invasion.

Scipio besieges Utica in Carthaginia. He can't withstand the combined forces of the Hasdrubal Gisco's Carthaginians and the Syphax's Numidians, so he's forced to abandon the siege. Then Scipio makes a surprise attack on the Carthaginian camp and destroys it. He sweeps down on the forces the Carthaginians and Numidians are mustering near the upper Bagradas River (in Tunisia), and Scipio smashes them in the Battle of the Great Plains. Syphax and Hasdrubal Gisco manage to escape separately.

Hasdrubal Gisco urges the Carthaginian bigwigs to raise a new army and send for Hannibal from Italy. Hannibal finally leaves Italy and returns to Carthage.

The Battle of Zama (130 kilometers southwest of Carthage) ends the Second Punic War and destroys the power of Carthage. Roman forces under the leadership of Publius Cornelius Scipio and his Numidian ally, Masinissa, defeat a combined army of Carthaginians and their Numidian allies under the command of Hannibal, who loses 20,000 men and narrowly escapes pursuit. Carthage is forced to capitulate.

Romans now see themselves as the dominant force in the Mediterranean basin.

China: The Qin emperor is overthrown. Han warlords begin a rapid expansion to the west. The Han dynasty will survive until 220 AD.

Far (17 Years)

Transition Period (183-178 BC)

Rome: The Roman statesman Titus Quinctius Flamininus is sent to the court of Prusias I, king of Bithynia, to demand the surrender of the former Carthaginian statesman and general Hannibal. When Hannibal finds out that Prusias is about to agree to the Roman demands and thus betray him, he poisons himself in the village of Libyssa in Bithynia.

Rome founds a colony at Aquileia (Trieste), on the narrow strip of land between the mountains and the lagoons, as a frontier fortress to check the advance of the Illyrians. Rome completes its subjugation of all of Italy with the defeat of the Ligurians in a battle near modern Genoa. Rome deports 40,000 Ligurians to other areas of the Republic.

The Pons Aemilius is completed across the Tiber River in Rome. It is regarded as the world's first stone bridge.

Near (11 Years)

Transition Period (166-161 BC)

Middle East: King Antiochus IV Epiphanes, after the failure of his Egyptian campaign, marches against suspected Judean rebels and orders his soldiers to cut down without mercy those whom they meet and to slay those who have taken refuge in their houses. In the space of three days, 80,000 are lost in Jerusalem, 40,000 meeting a violent death and the same number being sold into slavery.

The Battle of Beth Zur is fought between Jewish rebel forces led by Judas Maccabeus and a Seleucid army led by the regent Lysias. Judas Maccabeus wins

the battle and is able to recapture Jerusalem soon after. Judas purifies the defiled Temple in Jerusalem, destroys the idols erected there by Antiochus IV and restores the service in the Temple. The reconsecration of the Temple becomes an annual feast of dedication in the Jewish calendar, Hanukkah.

Anatolia: Construction of the detail of the frieze from the east front of the altar in Pergamon, *Athena Attacking the Giants*, begins and is finished eight years later.

Rome: Private documents collected by the Romans when they capture Perseus of Macedon incriminate political leaders of the Achaean League. Many influential Greeks are deported to Rome. On his way back to Rome, the Roman general Lucius Aemilius Paulus is ordered by the Roman Senate to inflict a brutal revenge on Epirus for being an ally of Macedonia. Seventy towns in Epirus are destroyed and at least 100,000 citizens are sold into slavery. These actions take place despite the fact that Epirus has not aided Perseus in his war with Rome.

Persia: The Parthians capture the key central Asian city of Herat. This victory effectively chokes off the movement of trade along the Silk Road to China and means that the Hellenic kingdom of Bactria is doomed.

Indian Subcontinent: The Sunga Empire is established in Indian subcontinent. Pusyamitra Sunga becomes the 1st-ruler after a palace coup. He and his offspring rulers patronize artisans and urbane culture. They follow the Brahman tradition, although Buddhism flourishes in outlying portions of the empire.

China: Laoshang leads 140,000 Xiongnu cavalry in a raid in Anding, and they reach as far as the royal retreat at Yong.

Far (17 Years)

Transition Period (143-138 BC)

Rome: The Spanish Insurrection ends when Quintus Caecilius Metellus Macedonicus crushes the Celtiberian rebels.

The Aqua Marcia aqueduct is built in Rome. Venus of Milo is sculpted. A

Rhodian admiral uses flame-throwing devices to burn enemy ships.

China: Emperor Wu of Han sends envoys into Bactria, Parthia and Ferghana.

Near (11 Years)

Transition Period (126-121 BC)

Rome: Marcus Fulvius Flaccus proposes the extension of Roman citizenship to the northern Italians, but the Senate reacts by sending him off to deal with disturbances around Massilia (Marseilles). In doing so, he commences the conquest of Transalpine Gaul.

Rome's victories around the Mediterranean have brought great wealth to the aristocrats who have bought huge tracts of land, which they farm with slave labor. Small farmers have been forced to sell their lands and migrate to the cities (mainly Rome) where they find they can barely make ends meet. Gaius Gracchus recognizes the potential to improve the lives of Rome's common folk, when he is elected Roman tribune for the 2nd-time. He and Marcus Fulvius Flaccus propose a number of radical reforms. They pass a law requiring the state to provide weapons and equipment for the soldiers in the Roman army, but they fail to muster enough support among the poor, so the aristocrats of the Senate snuff them out.

Far (17 Years)

Transition Period (103-98 BC)

Rome: The eternal city is in a state of emergency, for the way to Italy lays open to the Germanic invaders. Gaius Marius, the conqueror of Jugurtha, is elected consul for the second time. Gaius Marius defeats the Scirii and Teutones at the Battle of Aquae Sextae. The Cimbri defeat the Consul Quintus Lutatius Catulus in the Adige Valley. The Roman consuls Gaius Marius and Manius Aquillius defeat the Cimbri in the Battle of Campi Raudii.

Marius gains widespread popular acclaim because he has allowed commoners

to enlist in his legions. This gives the poor a sense of entitlement. Roman soldiers, after serving in the war, expect a reward of land. This drives a wedge between the military commanders and the wealthy landowners who make up the Roman Senate.

China: The Chinese under Emperor Wu of Han besieges and captures Kokand of Dayuan in the Hellenistic Ferghana Valley, during a two-year war with the Yuezhi.

Chinese ships reach the east coast of India. Silk-reeling machinery comes into use. Clothiers make drawn-looms for figured weaves.

Near (11 Years)

Transition Period (86-81 BC)

Rome: Cinna is elected consul of Rome, thus returning the rule of Rome back to the Marian faction.

Lucius Cornelius Sulla arrives in Greece and besieges Athens. He orders Lucius Licinius Lucullus to raise a fleet from Rome's eastern-Mediterranean allies. Sulla arrives in Greece and besieges Athens. He captures Athens from the Pontic army, removing the tyrant Aristion. Lucius Licinius Lucullus decisively defeats the Mithridatic fleet in the Battle of Tenedos. The Roman forces of Sulla defeat the Pontic forces of Archelaus in the Battle of Chaeronea. Sulla again defeats Archelaus in the decisive Battle of Orchomenus.

Lucius Cornelius Sulla returns to Italy from his campaigns in Greece and lands with his legions unopposed at Brundisium (Brindisi). Gnaeus Pompeius, age 22, raises a private army of three legions from his father's veterans and clientalae in Picenum. He joins forces with Sulla.

Lucius Licinius Murena, the Roman governor of Asia, clashes with the Pontic forces of Mithridates VI, starting the Second Mithridatic War.

Sulla defeats 90,000 Samnite allies in the Battle of the Colline Gate, and takes control of Rome. Gaius Marius the Younger is besieged at the fortress city of Praeneste in Latium. After a fierce resistance, Marius commits suicide. Sulla

orders Gnaeus Pompeius to stamp out democratic rebels in Sicily and Africa, while the young Gaius Julius Cæsar is acting as a subordinate of Sulla in the east.

Far (17 Years)

Transition Period (63-58 BC)

Rome: Pompey destroys the kingdom of Pontus; Mithridates VI commits suicide after escaping to the Crimea. This action follows Pompey's decisive victories to rid the Mediterranean Sea of pirates.

Julius Cæsar becomes governor in Hispania and creates 10th-Legio Gemina (3,500 men). He puts down the Callaici and Lusitani rebellions.

Julius Cæsar, Pompeius and Crassus form a mutual Triumvirate. Each has political clout and substantial wealth. They command the loyalties of soldiers which allow them to dominate the debate club that is the Roman Senate.

Cæsar rushes to Further Gaul to stop the incursions of the Germanic Helveti. Thus begins a nine-year campaign that will bring all of Gaul under the Roman jurisdiction.

Near (11 Years)

Transition Period (46-41 BC)

Rome: Dictator Julius Cæsar and his ally Cleopatra VII of Egypt defeat the forces of the rival Egyptian Queen Arsinoe IV in the Battle of the Nile. Ptolemy is killed; Cæsar then relieves his besieged forces in Alexandria. Cæsar defeats Pharnaces II of Pontus, king of the Bosporus, in the Battle of Zela. A year later at Thapsus (North Africa), he defeats the combined army of Pompeian followers and Numidians under Metellus Scipio and Juba. In his last victory, Cæsar defeats the Pompeian forces of Titus Labienus and Pompey the younger in the Battle of Munda in Spain. Labienus dies in battle, Pompey the younger is executed but Sextus Pompey escapes to take command of the remnants of the Pompeian fleet. This battle ends "Republican" resistance throughout the Roman world.

Cæsar reforms the Roman calendar. 365 days plus an extra day every 4th-year.

After Cæsar's death, the assassins Brutus and Cassius remove themselves from Rome. There is confusion in the Senate, while the common folk of the city openly mourn the passing of a hero. Octavian returns from Apollonia in Dalmatia to Rome to take up Cæsar's inheritance.

Marcus Junius Brutus at Dyrrachium defeats Gaius Antonius. Brutus proceeds to secure his position in Thrace and Macedonia. Gaius Cassius Longinus campaigns in Syria and defeats the army of Publius Cornelius Dolabella at Laodicea.

In the 1st-Battle of Philippi (Mousthéni), the Triumvirs Mark Antony and Octavian Cæsar fight an indecisive battle with Cæsar's assassins Marcus Brutus and Cassius. In the 2nd-Battle of Philippi, Brutus is defeated by Antony and Octavian. The Triumvirs smash through the weakened Republican center and take Brutus's right wing in its flank. In consequence, Octavian and Antony divide the Roman world between them. Antony receives the best provinces and legions. Octavian must find land for retired soldiers.

Far (17 Years)

Rome: The rivalry between Antony and Octavian continues. Antony's disastrous campaign against the Parthians contrasts with Octavian's victory over Sextus Pompey's pirate den. Antony's marriage to Cleopatra gives Octavian an excuse to go to war against his rival. Agrippa, Octavian's admiral, defeats the fleet of Antony and Cleopatra. The rest is a mop-up operation.

Transition Period (23-18 BC)

Rome: Octavian founds the city of Nicopolis in Egypt to commemorate his final victory over Mark Antony. Peace treaty between Rome and Parthia, in which the captured eagles of Marcus Licinius Crassus and Mark Antony are returned.

Following coinage reform, the *as* coin is struck in reddish pure copper, instead of bronze. The denominations of sestertius and dupondius are

introduced as large bronze coins.

The Nubians, led by queen Candace Amanirenas, take the initiative against the Roman Empire, and attack the Roman province of Egypt moving towards Elephantine. The Roman governor of Egypt, Gaius Petronius, marches with 12th-legio Deiotariana and 3rd-legio Cyrenaica up the Nile where he destroys the Nubian capital of Napata.

King Herod the Great begins renovation of the Temple in Jerusalem.

Marcus Vipsanius Agrippa completes the Aqua Virgo; the aqueduct is 20 kilometers in length and supplies the city with about 100,000,000 liters of water every day.

Marcus Verrius Flaccus' *De verborum significatu* is published. It is one of the first great dictionaries in history.

Near (11 Years)

Transition Period (6 BC - 1 BC)

Middle East: Possible birthdate of Jesus, marking appearance of a very bright triple conjunction of the royal star Jupiter and Saturn in the sign of Pisces.

Rome: Emperor Augustus sends ferrets to the Balearic Islands to control the rabbit plagues.

Following Herod's death, Publius Quintilius Varus, the Governor of Syria, assembles three of his four legions, including the 10th-Legio Fretensis, and marches down to Jerusalem from Antioch (Antakya) to restore order. He crucifies 2,000 Jewish rebels.

Lucius Domitius Ahenobarbus commands the Roman army in Germania and crossed the Elbe. He builds a pontoon viaduct over the marshes between the Rhine and the Ems.

Emperor Augustus is proclaimed Pater Patriae, or "father of the country" by the Roman Senate; this bestowed title is the logical consequence and final proof of Augustus' supreme position as princeps, the first in charge over the Roman state.

Far (17 Years)

Transition Period (17 AD - 22 AD)

Rome: Emperor Tiberius I acquits himself well enough, having been the express choice of Cæsar Augustus, the first acknowledged emperor.

A Roman army of 50,000 men commanded by Germanicus gains a great victory at Idistaviso, defeating the German war chief Arminius and recovering the lost eagles of Varus' legions. Germanicus employs North Sea fleet to avoid dangerous rivers, embarking an army in the Rhine delta aboard circa 1,000 ships. He defeats the Germans at Amisius river estuary and the Weser, but during its return the Roman fleet is partially destroyed by storms.

China: Water-powered trip hammer mill appears.

Near (11 years)

Transition Period (34-39 AD)

China: Although the usurpation of Wang Mang and the Chimei Rebellion are behind him, Emperor Guangwu now faces a new threat to the Han Dynasty, the Rebellion of Gongsun Shu in the Sichuan province. Gongsun's naval forces are unsuccessful against Han General Cen Peng, so Gongsun decides to fortify his position by blockading the entire Yangtze River with a large floating pontoon bridge, complete with floating fortified posts. He erects forts on both banks of the river for further missile fire and protects his barrier with a large boom.

After Cen Peng is unable to break through, he constructs several *castle ships* with high ramparts and ramming vessels known as *colliding swoopers*, which break through Gongsun's lines and allow Cen to quell his rebellion. Gongsun Shu is totally defeated three years later.

Middle East: Herod Antipas suffers major losses in a war with Aretas IV of Nabatea, provoked partly by Antipas' divorce of Aretas' daughter. According to Josephus, Herod's defeat was popularly believed to be divine punishment for his

execution of John the Baptist. Emperor Tiberius orders his governor of Syria, Vitellius, to capture or kill Aretas, but he is reluctant to support Herod and abandons his campaign upon Tiberius' death.

Rome: Following tradition, Emperor Tiberius chooses his successor, but his choice proves not very wise. The Roman Senate annuls Tiberius's will and proclaims Caligula Roman Emperor. Caligula becomes an even worse choice. Naevius Sutorius Macro is said to gain favor in the empire by prostituting his wife Eunius to Caligula.

A financial crisis hits Rome, due to poorly chosen fiscal policies. Land values plummet, and credit is increased. These actions lead to excessive land speculation, a lack of cash and a crisis of confidence. The primary victims are senators, knights and the wealthy. Many aristocratic families are ruined.

The problem of succession is proving to be the Achilles heel of the Empire. Weak emperors squander whatever good will the strong emperors amass.

Far (17 years)

Transition Period (57-62)

Middle East: War between Rome and Parthia breaks out due to the invasion of Armenia (Azerbaijan) by Vologases I, who had replaced the Roman supported ruler with his brother Tiridates of Parthia. Gnaeus Domitius Corbulo, commander in the East, launches his Armenian offensive against Parthia. He leads a Roman army (four legions) through the mountainous country of Armenia (Azerbaijan), against the fortress at Volandum, to the southwest of Artaxata (Kirovabad). After a siege of eight hours, Corbulo takes the city. The legionnaires massacre the defenders and plunder Volandum to their hearts' content.

Corbulo marches to Artaxata crossing the Aras River, along the valley he is shadowed by tens of thousands of mounted Parthian archers led by king Tiridates I. The city opens its gates to Corbulo, just as it had to Germanicus four decades before. When he takes the 250-year-old Armenian capital, Corbulo gives

the residents a few hours to collect their valuables and burns the city to the ground.

Corbulo captures Tigranocerta (near Cizre), Mesopotamia. He installs Tigranes VI, a Cappadocian prince, as ruler of Armenia (Azerbaijan). For the next four years, a cohort from 6th-Legio Ferrata and 10th-Legio Fretensis are supported by 1,500 auxiliaries and stationed in the capital as bodyguard to the king.

Briton: Paulinus defeats the rebels at the Battle of Watling Street using a flying wedge formation, and imposes wide-ranging punishments on native Britons. The Romanization of the island continues.

The Emperor Nero uses a miniature reading lens, which is a transparent gemstone affixed as a ring.

Near (11 years)

Transition Period (74-79)

Rome: The Roman governor Lucius Flavius Silva lays siege to Masada, the last outpost of the Jewish rebels following the end of the First Jewish Revolt. The Roman 10th-Legio Fretensis surrounds the mountain fortress with a seven-mile long siege wall and builds a rampart of stones and beaten earth against the western approach. After the citadel is conquered, 960 Zealots under the leadership of Eleazar ben Ya'ir commit mass suicide.

Emperor Vespasian begins a vindictive sweep of the territory east of the upper Rhine and south of the Main. In addition, he reorganizes the defenses of the upper and lower Danube.

China: Historian Ban Gu develops a theory of the origins of the universe.

Far (17 years)

Transition Period (97-102)

Rome: Trajan is the first Roman Emperor born outside Italica, near Seville. A

brilliant soldier and administrator, he enters Rome without ceremony and wins over the public. Continuing the policies of Augustus, Vespasian and Nerva, he restores the Senate to its full status in the government. He has a specific vision of the Empire, and keeps a close watch on finances. Normal taxes are sufficient during his reign to pay the full costs of the imperial budget.

Emperor Trajan returns to Rome from the inspections of the troops along the Rhine and Danube frontiers. The Roman Army throughout the Empire is numbered at 300,000 soldiers (45 Legions plus shipboard marines).

Emperor Trajan starts an expedition against Dacia (Romania), exceeding the limits of the Roman Empire set by Augustus.

Technology: Hero, a Greek mathematician of Alexandria, invents an olive-oil beam press, a grape-screw press, a screw-powered cutting machine, water- & wind-powered musical instruments, a “Holy Water” slot machine and a steam-powered whirling aeoliphile.

Near (11 years)

Transition Period (114-119)

Middle East: Osroes I of Parthia violates the treaty with Rome by installing a puppet ruler in Armenia (Azerbaijan). The 60-year-old emperor, Trajan, marches east without first attempting to use diplomacy to resolve the disagreement. He defeats the Parthians and overruns Armenia and northern Mesopotamia. He captures the Parthian capital of Ctesiphon (Baghdad).

Lusius Quietus, Trajan’s governor of Judea, begins a brutal campaign to maintain the peace in the region.

Emperor Trajan completes his invasion of Parthia by capturing the cities of Seleucia, Babylon, Ctesiphon and Susa, marking the high-water mark of the Roman Empire’s eastern expansion. Trajan makes Syria a province of Rome and crosses the Tigris to annex Adiabene. He proceeds with his army to the Persian Gulf and conquers territory that becomes the province of Parthia.

Trajan sends two expeditionary forces. One consists of elements of 3rd-Legio

Cyrenaica to suppress the revolt in Judea; the other consists of the 7th-Legio Claudia to restore order on Cyprus. Emperor Trajan dies of a stroke at Selinus in Cilicia at age 63, while en route from Mesopotamia to Italy. The Roman Empire is at its greatest territorial extent.

Far (17 years)

Transition Period (137-142)

Rome: The war against the Suebi begins. In 138 they will be defeated by the senator Tiberius Haterius Nepos Atinas, governor of Pannonia (Serbia). The silver content of the Roman denarius falls to 75 percent under emperor Antoninus Pius, down from 87 percent under the reign of Hadrian.

Middle East: Tax laws are passed for trade in Palmyra (Tadmur). The caravan city grows rich by importing rare products from the Persian Gulf, and by exporting items manufactured by the Mediterranean world to the East.

Near (11 years)

Transition Period (154-159)

Rome: Emperor Antoninus Pius starts a new war against the Parthians who are led by Vologases IV. The war is brief and results in an inconclusive peace.

Far (17 years)

Transition Period (177-182)

Rome: Commodus becomes Roman Emperor. He accepts advice from the wrong people. He becomes weak and paranoid and vengeful. His reign marks the start of the Empire's decline.

Technology in China: Gimbals, rotary ventilation fan and lamp cover revolved by ascending air.

Near (11 years)

Transition Period (194-199)

Rome: The Senate chooses Publius Helvius Pertinax, against his will to succeed the late Commodus as Emperor. Pertinax is forced to reorganize the handling of finances, which has been wrecked under Commodus, and to reestablish discipline in the Roman army. Pertinax suspends the food programs established by Trajan. This provokes the ire of the prætorians, who storm the imperial palace and assassinate him. The Empire is auctioned off. Marcus Didius Julianus, the highest bidder, offers 300-million sesterces as a bonus for the prætorian Guard.

Septimius Severus enters the capital and has Julianus put to death. He replaces the prætorian Guard with a 15,000-man force from the Danubian legions. Severus takes control of the Roman Empire.

In Britain Clodius Albinus allies with him by accepting the title of Cæsar. British tribes take advantage of the disorder caused by the civil war and damage Hadrian's Wall. The legionaries carry out extensive repairs to the defensive works.

Emperor Septimius Severus marches with his army (12 legions) to Cilicia and defeats Pescennius Niger, governor of Syria. Pescennius retreats to Antioch (Antakya) and is executed by Severus' troops. King Vologases V and other eastern princes support the claims of Pescennius Niger. The province of Mesopotamia rises in revolt with Parthian support. Severus travels to Mesopotamia to battle the Parthians.

Decimus Clodius Albinus, who had been proclaimed emperor in Britain, crosses into Gaul with his legions, while at the same time recruiting new soldiers. He is soon the head of an army of 150,000 men. Severus, still in Mesopotamia, marches hastily west where he defeats the self-proclaimed emperor Albinus at Lugdunum (Lyon). Albinus commits suicide.

Severus forms new naval units, manning all the triremes in Italy with heavily armed troops for war in the East. Soldiers embark on an artificial canal between

the Tigris and Euphrates. The Roman army marches east to repel a Parthian invasion of Mesopotamia, they loot the royal palace at Ctesiphon (Baghdad) and capture an enormous number of its inhabitants as slaves.

Far (17 years)

Transition Period (217-222)

Rome: The degenerate Elagabalus becomes the Emperor. From this time forward, the imperial court holds itself above military affairs, and non-Romans are increasingly recruited for the legions.

Near (11 years)

Transition Period (234-239)

Rome: Within five months of 238, five Emperors declare themselves and meet untimely deaths. Maximus Thorax is murdered by troops in Aquila. Gordian I and Gordian II commit suicide in Carthage. Propius and Balbinus are murdered by the prætorian guards.

With so much uncertainty and confusion, the reins of government fall to the bureaucrats. These officials may be efficient at their jobs, but they seldom have a keen grasp of the entire sweep of government policies. Without direction from above, officials will protect their turfs and step on each other's toes. Worse yet, greedy functionaries will take every opportunity to siphon public funds for their personal agendas. Each violent change of emperors causes more civic decay and social malaise.

Persia: King Ardashir I defeats Artabanus IV at Hormizdegan (modern Shushtar), destroying the Parthian Empire and establishing the Sassanid dynasty. Artabanus's brother Vologases VI will continue to rule with Armenian and Kushan support over outlying parts of Parthia. King Ardashir I, ruler of the Sassanid dynasty, defeats Artabanus IV and is crowned "King of Kings" of the Persian Empire. This begins of the 400 year-reign of the Sassanid Empire.

China: A merchant from the Roman Empire called “Qin Lun” by the Chinese, arrives in Jiaozhi (modern Hanoi) and is taken to see Sun Quan, king of Eastern Wu, who requests him to make a report on his native country and people. He is given an escort for the return trip including a present of ten male and ten female “blackish-colored dwarfs.” However, the officer in charge of the Chinese escort dies and Qin Lun has to continue his journey home alone.

The Battle of Jieting and the Battle of Shiting are fought in China.

Far (17 years)

Transition Period (256-261)

Rome: Cities in the Roman Empire start to build walls as the defense of the frontiers begins to crumble. The Franks cross the Rhine, the Alamanni reach Milan. The Goths appear at the walls of Thessalonica. In Africa, the Berbers massacre Roman colonists. King Shapur I invades Mesopotamia and Syria. He conquers and plunders Antioch (Antakya).

The future emperor Aurelian inspects and organizes the defenses along the Rhine. He defeats the Goths and brings many prisoners back to Rome.

Goths invade the Balkan Peninsula where they commandeer boats of all kinds to raid coastal communities around the Black Sea. Encouraged, they embark on further raids, force their way through Hellespont and pillage wealthy cities around the Aegean Sea.

Emperor Valerian recovers Antioch from the Persian king Shapur I. Then he leads an army (70,000 men) to relieve Edessa (Urfa), besieged by the forces of king Shapur I. An outbreak of a plague kills many legionaries, weakening the Roman position in Syria.

Near modern Milan, Roman legions under Gallienus defeat a Germanic confederation of 300,000 Alamanni who have crossed the Alps. Gallienus repeals the edict of 258, which led to the persecution of the Christians.

The amount of silver in the Roman denarius falls below 10%. The crisis ruins craftsmen, tradesmen and small farmers. They are forced to bartering.

Landowners expand their holdings as they buy up cheap land.

Near (11 years)

Transition Period (273-278)

Rome: Emperor Aurelian recovers the Gallic Empire (Gaul and Britain). Tetricus I surrenders his army near Châlons-sur-Marne, France. Aurelian issues an important reform of Roman currency.

Germanic tribes stream across unguarded borders, since the Roman legions have been redeployed during the civil war. The Franks pillage and depopulate large areas of Gaul, including Paris. The Rhine border is lost for 20 years. Franks settle into southern Netherlands, northern Belgium and Rhineland.

Emperor Aurelian prepares a campaign against the Sassanids in Asia Minor. In Thrace, while waiting to cross the Bosphorus with his army, he hands out severe punishments to corrupt soldiers and makes a list of high-ranking officers marked for execution. Aurelian falls victim to a conspiracy of the prætorian Guard and is murdered near Byzantium.

Florianus becomes Roman Emperor; he breaks off his campaign against the Heruli and marches from the Bosporus with support from the Roman legions in Britain, Gaul, Spain and Italy to fight an indecisive battle with Marcus Aurelius Probus in Cilicia.

Emperor Probus travels with his army west across the Euxine Sea and through the provinces of Thrace, Moesia, and Pannonia (Serbia) to defeat the Goths along the lower Danube. He acquires from the troops the title of Gothicus. Probus defeats the Alamanni, advancing through the Neckar valley. He expels the Franks from Gaul and reorganizes the Roman defenses on the Rhine. He resettles the Germanic tribes in the devastated provinces of the Roman Empire.

Far (17 years)

Transition Period (297-302)

Rome: Constantius Chlorus assembles two invasion fleets with the intent of crossing the English Channel. The first is under the command of Asclepiodotus, Constantius' long serving prætorian Prefect who sails from the mouth of the Seine, and lands near the Isle of Wight where his forces defeat the usurper Allectus in Hampshire. Constantius leaves with his fleet Boulogne and occupies London, saving the city from an attack by Frankish mercenaries who are roaming the province. Constantius rebuilds the cities Eboracum (York), Londinium (London) and Verulamium (St Albans).

Emperor Maximian, mobilizes an army, consisting of prætorian cohorts, Aquileian, Egyptian and Danubian legionaries marching through Spain. He crosses the Strait of Gibraltar into Mauretania (modern Morocco) to protect the area against Frankish pirates. He begins an offensive against the Berbers in Mauritania, driving them back into their homelands in the Atlas Mountains.

Constantius Chlorus defeats the Alamanni in the territory of the Lingones (Langres) in Gaul. He strengthens the border along the Rhine frontier.

Galerius signs a treaty with the Persian king Narseh that will last for 40 years. The Persians accept Roman dominion over Armenia (Azerbaijan) and northern Mesopotamia. The Tigris becomes the boundary between Rome and the Sassanid Empire.

The Franks penetrate into what is now northern Belgium.

Emperor Diocletian issues his Edict on price controls. Instead of halting rampant inflation and stabilizing the economy, the controls add inflationary pressures by flooding the economy with new coinage and by setting price limits too low. He begins the construction of new roads in the Roman Empire.

Indian Subcontinent: The Kama Sutra, an Indian handbook on the art of sexual love, is probably produced around this time by the sage Vatsyayana.

Tiridates III makes his kingdom of Armenia the first state to adopt Christianity as its official religion.

China: The magnetic compass for navigation is invented.

Near (11 years)

Transition Period (314-319)

Rome: Edict of Milan: Constantine the Great and co-emperor Licinius meet at a conference in Mediolanum (Milan). They proclaim a policy of religious freedom for all, ending the persecution of Christians in the Roman Empire and returning property confiscated from Christians.

In the Battle of Tzirallum, Licinius defeats his rival Maximinus II and becomes Emperor of the Eastern Roman Empire. Maximinus flees to Nicomedia and commits suicide.

In the Battle of Cibalae, Constantine the Great defeats his rival Licinius near the town of Colonia Aurelia Cibalae (modern Vinkovci, Croatia). Licinius is forced to flee to Sirmium, and loses all of the Balkans except for Thrace. Peace negotiations are initiated between the two Augusti, but they remain unresolved.

Constantine battles the Sarmates, the Goths and the Carpians along the Danube. He leads a punitive expedition into Dacia (Romania) and reestablished the Roman fortifications of the frontier. In the Battle of Mardia, Constantine I defeats his rival Licinius and senior officer Valerius Valens near the town of Harmanli (Bulgaria).

Emperor Constantine the Great issues an edict prohibiting the punishment of slaves by crucifixion or facial branding.

China: The Chinese Empire loses its territories to the north of the Yangtze River, to the benefit of the Xiongnu and the Xianbei. The Former Zhao state is proclaimed; Liu Can and the state ruling family at Pingyang is executed by a coup d'état of Jin Zhun, who is in turn overthrown by Shi Le and Liu Yao.

Far (17 years)

Transition Period (337-342)

Rome: Constantine the Great dies in Achyron near Nicomedia at age 65 after

he is baptized by Eusebius of Nicomedia. Constantine is the first Christian Roman Emperor of the Western empire (312–324) and of the Roman Empire (324–337).

King Shapur II of Persia begins a war against the Roman Empire. He sends his troops across the Tigris to recover Armenia (Azerbaijan) and Mesopotamia. He besieges the Roman fortress of Nisibis (Syria), but is repulsed by the forces under Lucilianus.

Emperor Constantius II hastens to his territory in the East, where a revived Persia under king Shapur II is attacking Mesopotamia. Shapur II begins a widespread persecution of Christians. Ordering forcible conversions to the state religion, Zoroastrianism, lest the Christians disrupt his realm while he is away fighting the Romans in Armenia and Mesopotamia. For the next 11 years, Romans and Persians engage in a war of border skirmishing with no real victor.

Western Emperor Constantine II crosses the Alps and at Aquileia (Trieste) attacks the army of Constans I who ambushes and kills his rival. Constans I becomes the sole ruler of the Western Roman Empire, co-ruling with his brother Constantius II in the East.

Emperor Constans I bans pagan sacrifices and magic rituals under penalty of death. He begins a successful campaign against the Franks.

Near (11 years)

Transition Period (354-359)

Rome: In the Battle of Mons Seleucus, Emperor Constantius II defeats the usurper Magnentius, who commits suicide in Gaul in order to avoid capture. The armies of the West have withdrawn to participate in the battle, which allows hoards of barbarians (Franks and Alemanni) to cross the upper Rhine and invade the lands of the Helvetians. Constantius becomes sole emperor and reunifies the Roman Empire.

Emperor Constantius II raises his cousin Julian the Apostate to the rank of Cæsar. Julian takes command of the western provinces and marries Constantius'

sister, Helena. In the Battle of Reims, the Alemanni at Reims defeat Julian. In the Battle of Brumath, Roman forces pursue Germanic insurgents through the Gallic countryside. Julian wins an open battle near Brumath (Alsace). He builds in Gaul a fleet to secure the corn supply from Britain for the garrisoned forts along the Rhine. In the Battle of Strasbourg, Julian wins an important victory against the Alemanni, driving the barbarians across the Rhine.

Emperor Constantius II builds new forts to secure upper Mesopotamia. Persia's king Shapur II sends an emissary to Constantinople with gifts and a letter wrapped in white silk. He asks Constantius II to return the lands of his ancestors from the Euphrates to the frontier of Macedonia. Constantius II tactfully refuses to cede any territories.

The Salian Franks capitulate to Julian the Apostate in Gaul. He allows them to form a Roman foederati in Toxandria. Frankish settlers are established in areas in the north and the east to help with the defense of the Rhine frontier.

China: Wang Xizhi, Chinese calligrapher, produces *Preface to the Poems Composed at the Orchid Pavilion* in running script style. It becomes a model for future calligraphers.

Far (17 years)

Transition Period (377-382)

Rome: Barbarian horsemen wipe out Emperor Valens and six imperial legions in Thrace. The defeat spells the death knell for Pax Romana.

Near (11 years)

Transition Period (394-399)

Rome: Theodosius reunites empire for the last time and establishes Christianity as the official religion.

Far (17 years)

Transition Period (417-422)

The Visigoths occupy Aquitaine and invade Hispania.

Near (11 years)

Transition Period 434-439)

The Huns under Rugila devastate Thrace and move steadily towards Constantinople. When the citizens are preparing themselves for a long and ugly siege, Emperor Theodosius II bribes the Huns (after the death of Rugila) to keep the peace in the Eastern Roman Empire.

Vandals retain Mauretania and a part of Numidia. They use Hippo Regius (Annaba) as a seaport for their expeditions and establish a merchant fleet to transport goods and armies between Africa and the Italian mainland. The Vandals will eventually sack Rome and their name will be forever associated with senseless and wanton destruction.

Far (17 years)

Transition Period (457-462)

Chinese mathematicians calculate *PI* to better than six decimal places. Western mathematicians don't equal this feat for another 700 years and then only by cribbing info from Arab scholars.

Near (11 years)

Transition Period (474-479)

Last Roman Emperor of the West relinquishes his title.

Far (17 years)

+ + +

Place Names of Antiquity

Bactria covers parts of Turkmenistan and Uzbekistan.

Bithynia is a Roman province in northwest Turkey.

Briton coincides with present-day England.

Cilicia is a Roman province located in present-day Turkey on the north shore of the northeast corner of the Mediterranean Sea.

Etruria is an ethnic area northeast-central Italy.

Euxine Sea coincides with present-day Black Sea.

Gaul covers present-day France, Belgium, southern Netherlands and western Switzerland.

Helot is the contemporary Greek name for slave.

Parthia covers the territories of Iraq, Iran and Afghanistan.

Thrace is located in present-day northern Greece and southern Bulgaria.

Umbria is an ethnic area in northwest-central Italy.

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The Lens of Time

Some of you may doubt the soundness of linking astronomical events with broad cultural changes. There doesn't seem to be a sure physical link between the two. Neither is there a sure physical link between seasonal weather and human behavior. But I can assure you that folks in Canada tend to go swimming more often in July or August than they do in December or January. But the reverse can happen as well. In Vancouver there is the annual Polar Bear event that takes place on New Year's day. A few hardy celebrants will plunge themselves into the frigid waters of English Bay. The drastic emersion is supposed to be a sure-fired cure for overindulgence on New Year's eve. But the Polar Bear plunge is an exception and not recommended for the faint of heart.

Sensible readers should treat the 40-Year Cycle in the same way. It is not a constraint but a useful tool.

Transitional periods cover 30% of the chronological timeline. After examining the sections of Way-Back History, you have gained a good historical prospective by skimming events in the Transition Periods. That in itself supports my contention that six-year Transition Periods feature the dynamic moments of cultural change. I liken this phenomenon to a stew pot that simmers for many years before coming to a boil and causing humans to get off their behinds to perform great deeds. I can't answer *why this should be*. My intent has been to draw your attention to the historical evidence.

Near and Far periods represent 70% of occurrences during the 40-

year cycles. For example, the Fall of Constantinople and the defeat of the Spanish Armada happened outside of Transition Periods. Neither of these events is as important as scholars would have you believe. The Byzantine Empire had become irrelevant long before the sack of its capital city. As for the Spanish, the loss of their fleet was the least of their problems. They had hitched their wagons to the Vatican's outdated notions of usury, so their hoards of gold and silver from the Americas were never assimilated effectively into the European economy.

Another episode outside the Transition Periods was Hannibal's alpine invasion of Italy and his brilliant victories over the Romans, but his efforts resulted in defeat for Carthage. Alexander the Great conquered the known world, but he founded a kingdom that didn't survive his death. Likewise are the early victories of Genghis Khan in Mongolia and northern China. These would inspire further conquests of Asia and Eastern Europe. Yet the Mongol onslaughts, though bloodthirsty and disruptive, triggered a brief economic boom which collapsed during the Black Plague. Afterward, Chinese, Hindus and Muslims reverted to their cultural roots. The Apollo moon shots have inspired worldwide praise, but they lifted off like a PR exercise and returned nothing but a pail of rocks.

Near and Far periods are not subjects of this report, yet they deserve a few cursory observations. During the Near periods, socioeconomic changes tend to be plodding and tentative, yet productive. For example, Australia extended voting rights for women to all of its provinces and territories. Its parliament enacted the Conciliation and Arbitration Act, which recognized trade unions and

established a sensible framework for settling labor disputes. At the time, other nations found this legislation controversial. It would take two world wars before the UN drafted its white paper on Human Rights, extending similar democratic principles across the globe.

During Far periods, economic progress tends to be volatile and speculative, while organizations and individuals often bite off more than they can chew. The meteoric rise and fall of Napoleon happened during a Far period. Another Far period encompassed the Roaring 20's followed by the stock market crash of 1929. More recently, we have witnessed the DOT-COM boom and bust as well as the financial crisis of 2008.

While seminal events have been shown to occur during the six-year Transition Periods, the root causes for these outbreaks must be incubating over years and decades beforehand. It would be foolish to wait until a Transition Period arrives to correct social imbalances. We must be on the constant lookout for whatever injustices that could build and erupt in future catastrophes. There is no time like the present to look at ourselves and our lifestyles and to make whatever changes need changing.

The 40-year cycle may be a fluke or mere coincidence. On the other hand, the 40-year cycle may prove a valuable tool for policymakers if the oscillations can be better understood. The 40-year cycle may give insights toward solving the grave issues of climate change and global disparity. We ought to find ways to prosper without ruining our natural heritage. We should be able to diffuse terrorism with knowledge, not smart bombs.

One question remains. What is the exact length of the 40-year

cycle? That question requires someone with more astrodynamical expertise than myself. Once the exact length of the 40-year Cycle is determined, historians will have an extended road map. They can focus on those events of antiquity that are regarded noteworthy by a consensus of minds. Transition periods can be mapped with confidence only if the 40-year cycle lasts 14,610 days. Otherwise I suspect the periods will slide forward or backward in time.

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Endnotes

1. Geocentric angular separations between Venus & Mercury have been taken from the following sources: Max S. Metz, *Ephemerides 1890-1950*. Neil F. Michelson, *The American Ephemeris for the 20th-century* (Revised Edition). Neil F. Michelson, (Revised by Rique Pottenger) *The American Ephemeris for the 21st Century* (2001-2050). [Back](#).
- 2 The length of the Tropical Year has been quoted from J. M. A. Danby, *Fundamentals of Celestial Mechanics*, (Revised 2nd-edition), Willmann-Bell, Inc., 1988. [Back](#).
3. Daily heliocentric positions of Earth, Venus and Mercury have been calculated using my own shareware program. With special thanks to Jean Meeus, *Astronomical Formulae for Calculators* (4th-Edition, Revised & Enlarged), Willmann-Bell, Inc., 1988. [Back](#).
4. Historical data has been selected vis-à-vis the author's knowledge from his reading of many original sources. The actual events and dates have been excerpted from the following sources: Wikipedia; *World Almanac 1993-1996*; *Time Almanac 2001-2006*; Kevin Desmond, *A timetable of Inventions and Discoveries*, M. Evans & Company, Inc., 1986. And special thanks to Project Gutenberg <http://www.gutenberg.net> [Back](#).

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I welcome anyone with astrodynamical expertise to confirm my statistical approach. So far, I've determined the triple conjunction of Earth, Venus and Mercury occurs once every 40 years less about ten days, but this doesn't prove the length of the cycle, since the triple conjunction could migrate with the cycle's

duration. I need outside help to make an accurate reckoning on the length of the cycle and where its boundaries should be drawn. Once confirmed, the 40-year cycle can be extended far into the past with confidence. If someone reading this report is interested in collaborating, please contact me.

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